The Glass Industry

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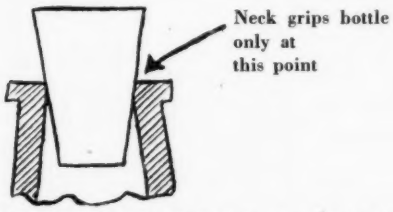
Vol. 4. DECEMBER, 1923 No. 12

The Bottle Neck and the Tapered Cork

The Correct Relation of Corks to Necks of Bottles

What kind of a neck must a bottle have to ensure with a tapered cork a perfect seal? This undoubtedly is a question of importance to the bottle manufacturer, the cork maker, and to their common customer, the bottler. All three of the individuals at the corners of this triangle are keenly aware of the difficulties involved and the troubles incurred in trying to make the corks fit the bottles, or the bottles fit the corks, so that together they will hold tight and not leak.

Unless a bottle neck is made properly, a tapered cork will not give a satisfactory seal. It is impossible to make a tight closure in some bottles no matter how carefully the cork manufacturer tries to supply stoppers of the proper size. The most troublesome bottles from the cork manufacturer's standpoint are those in which the inside of the neck tapers outward from the top, as shown in the accompanying sketch.



NECK TAPERING OUTWARD FROM TOP—VERY BAD TYPE

The most troublesome defect is found where the neck conforms to the taper of the cork for a short distance and then breaks away leaving but small contact surface with the cork. Any corks small enough to be inserted by hand in such bottles make contact with the glass at the edge of the neck only. This does not give sufficient corkage and the bottles invariably leak. Probably necks of this kind are due to the flowing away of the glass when the bottles are blown, but this, the cork manufacturers claim, can be remedied by reinforcing the necks to the depth required for proper corkage.

A study of conditions was made recently by the Armstrong Cork Company, who are large manufacturers of corks and who during the past year or so have done considerable work with leading bottle manufacturers and have arrived at certain conclusions regarding the problems involved.

After quite exhaustive tests it has been determined that corks can be inserted and removed by hand more easily if they are tapered 3/16 of an inch per inch of length than if any other degree of taper is used. The Armstrong investigators have determined that the same taper should be followed in regard to the bottles, *i.e.*, the necks should taper inward (get smaller) 3/16 of an inch per inch of length. If it is impossible to taper them to this degree, anything approaching it is preferable to an absolutely straight neck; but, as stated above, necks that taper outward are quite impracticable. Straight necks are far preferable to this kind.

The statements above apply only to the use of tapered corks where the bottler wishes them to protrude from the necks of the bottles ½ inch or more, so that they can be removed readily by hand. It does not apply to bottling where straight corks are inserted flush with the top of the neck.

As a result of their investigation the Armstrong staff has prepared drawings, reproduced on the next two pages, showing examples of what they conceive to be the correct relation of tapered corks to necks of bottles, and offering a definite ideal for the bottle manufacturer to aim at if he would make his product more satisfactory to his customers.

The other chart is a guide to the sizes and taper of corks of short length, regular length, extra long, and extra extra long. All of the corks are tapered to conform to the United States standard taper of 3/16 of an inch to each inch of length.

The corks ordinarily are graded as to size from 0 to 26, according to the diameter of the top, or large end. Each advance in size of shorts and regular lengths represents an increase of 1/16 of an inch in large end diameter.

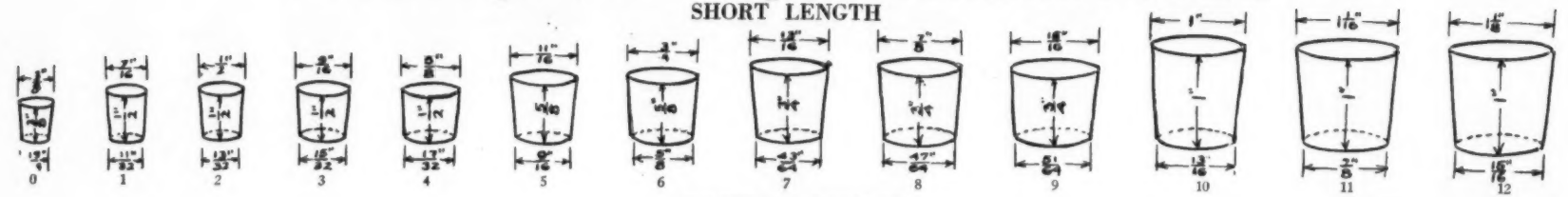
The same difference is found in sizes from number 20 up, but they are not listed here, as they are infrequently used.

Corks are also made in sizes smaller than a No. 0 when required.

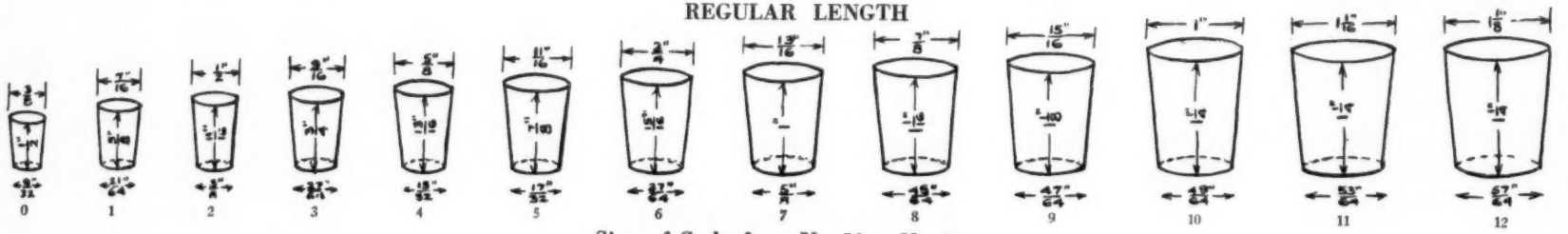
Further co-operation between bottle and cork manufacturers will tend to establish a common aim for both, eliminate work at cross purposes and lead to a better understanding all around as to what can be done to make their products more serviceable and therefore more satisfactory to their customers.

Sizes and Taper of Armstrong's Corks From No. 0 to No. 12

SHORT LENGTH



REGULAR LENGTH

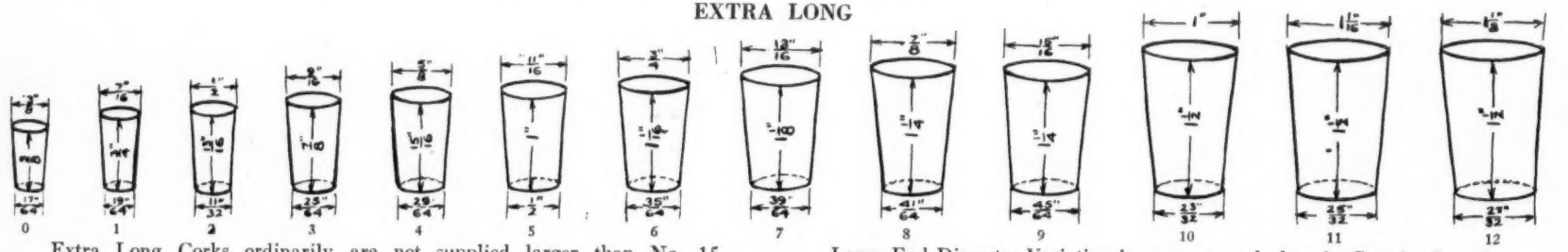


Sizes of Corks from No. 13 to No. 20

Diameter at Large End

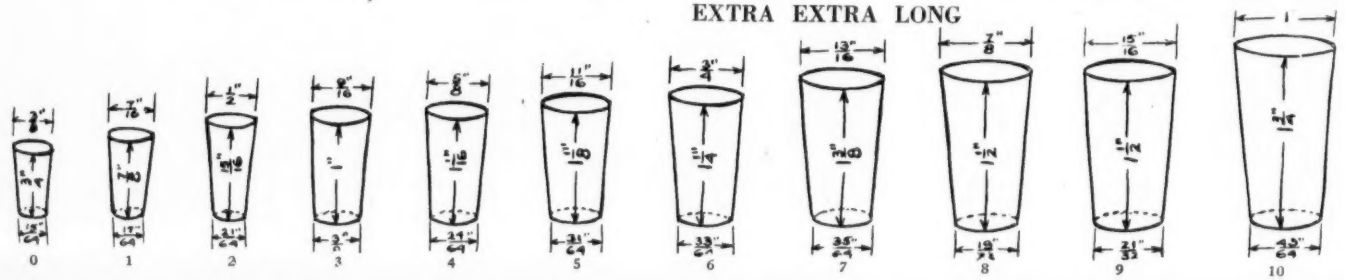
No. 13 ..... 1 3/16 in.	No. 16 ..... 1⅜ in.	No. 19 ..... 1 9/16 in.
No. 14 ..... 1¼ in.	No. 17 ..... 1 7/16 in.	No. 20 ..... 1⅝ in.
No. 15 ..... 1 5/16 in.	No. 18 ..... 1½ in.	

EXTRA LONG



Extra Long Corks ordinarily are not supplied larger than No. 15. Large End Diameter Variation is same as marked under Regular Lengths.

EXTRA EXTRA LONG

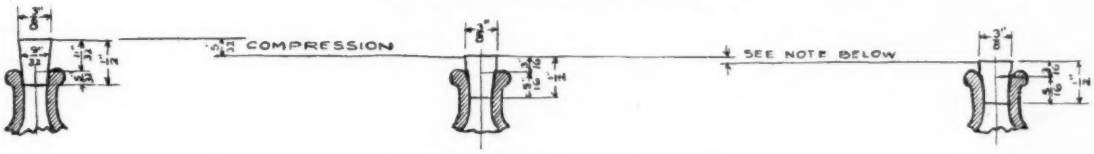


Extra Extra Long Corks ordinarily are not supplied larger than No. 10. Large End Diameter Variation is same as marked under Regular Lengths.

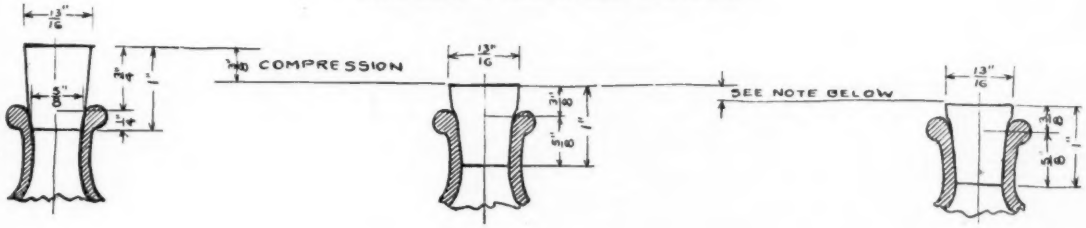
Examples Showing Relation of Tapered Corks to Necks of Bottles

I	II	III
CORK LIGHTLY SET IN NECK OF BOTTLE	CORK PRESSED OR DRIVEN IN NECK OF BOTTLE	CORK PRESSED OR DRIVEN IN A FLARE NECKED BOTTLE

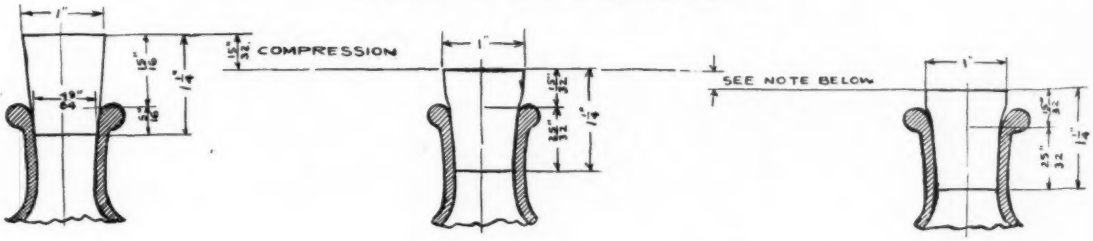
NUMBER O REGULAR LENGTH



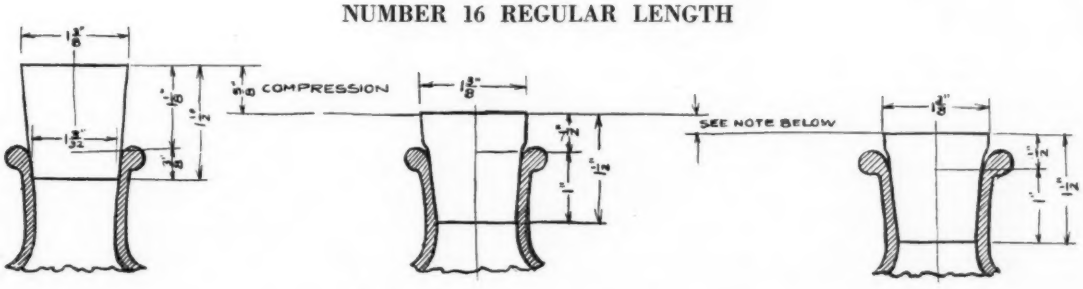
NUMBER 7 REGULAR LENGTH



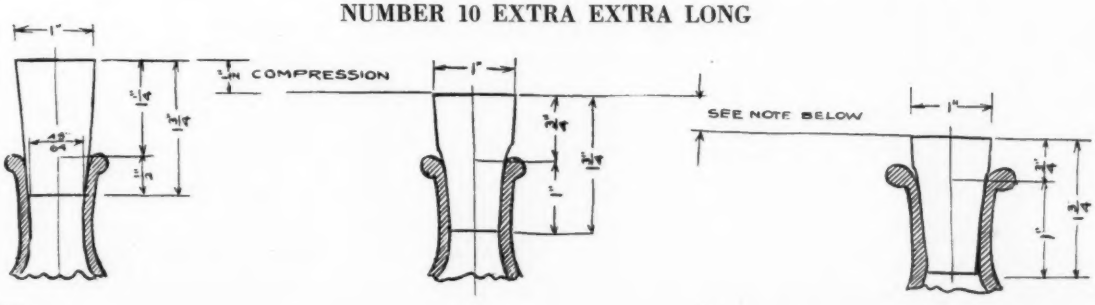
NUMBER 10 REGULAR LENGTH



NUMBER 16 REGULAR LENGTH



NUMBER 10 EXTRA EXTRA LONG



NOTE:

Compression of corks in bottles in third column is same as in second column but cork sits lower in bottle because of flare neck.

The Geology of Glass Sands*

The origin of the great deposits of silica sands which are of so much commercial importance to New Jersey, Pennsylvania, Ohio, Illinois and Missouri

†By Howard West Elkington

Sand is the common name for a very large mineral family. Nature has been not only generous but almost profligate with the deposits of sand in the United States. In considering the sand suitable for glass making, we can discard most of the members of the sand family and confine our attention to those sands which are relatively free from iron and have a high silica content. An ordinary glass sand should have less than 0.28 per cent iron (.20 per cent Fe_2O_3) and more than 98 per cent SiO_2. The layman will naturally ask in what way can such a tiny trace of iron make a difference to the manufacturer. To this question the glass maker will reply with some heat that, impossible as it may seem, one-half of one grain in 100 grains of sand can affect the color of his glass to such a degree that it will spoil a batch.

THE MUCH PRIZED HIGH SILICA SAND

The fundamental reason why iron is so disproportionally disturbing is not clear, even to the glass maker. It is much more obvious why a high silica content is desirable. Some sands contain an almost negligible amount of iron and are practically pure silica. They analyze less than .02 per cent iron and are more than 99 per cent silica. These sands are much sought after by glass makers and it is the descriptions of the deposits of such sands that this paper will take up, although there are other interesting members of this fascinating sand family which we are loath to desert.

The illustration of a large crystal of quartz shows a giant member of the glass sand mineral group, the tiny members of which are of such importance to the glass maker. But it is not entirely accurate to consider all sand as originating in quartz crystals, for some glass sands are laid down in silicious beds and, even upon close microscopic examination show only slight crystalline structure. However, it is safe to say that the majority of glass sands are the surviving heirs of crystals or crystalline formations. If such a statement is followed, it almost strains the imagination and takes one back over vast periods of geologic time, a most romantic journey to the painstaking, observant geologist or enthusiastic student.

AN EXCEPTIONALLY FINE PHOTOGRAPH OF A QUARTZ CRYSTAL. SUCH CRYSTALS ARE THE "PARENTS" OF MOST GLASS SANDS

Before this is illustrated in full detail, consider the five large glass sand producing fields which are in New Jersey, Pennsylvania, Ohio, Illinois and Missouri. Many readers may be familiar with the sands of the Jersey shore. It is not these but sands of the interior which attract our attention. These sands in the interior are, generally speaking, refuse sands; that is, they are deposits of quartz grains laid down in lens-shaped beds, due directly to the geological conditions under which this region was prepared. Because every grain in this area has had a checkered and tumbled past, the grains generally show smooth edges and signs of much wear. For a similar reason, although some beds of Jersey sand are relatively rich in grains of a low iron and high silicate content, the beds as a whole are badly contaminated by other refuse materials. The geologist would expect to find no other state of affairs in a region that is built up as a result of the disintegration of large land masses by the

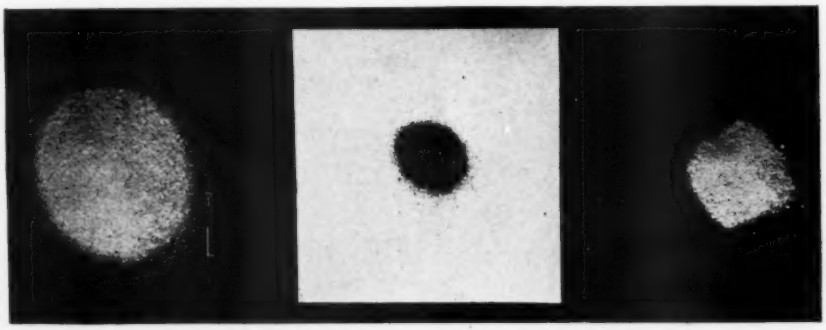


FIG. 3—ON THE LEFT, SAND WITH ILMENITE AND RUTILE, AS SHOWN IN FIGS. 1 AND 2. RIGHT, THE CLEAN SAND AND, CENTER, THE ILMENITE AND RUTILE WHICH HAVE BEEN REMOVED BY A MECHANICAL SHAKER

* Published in *Rock Products*, Sept. 22, 1923.
† Philadelphia Quartz Co.

destructive action of the weather and the freakish deposition of the sea on a badly disturbed floor.

Deposits of a similar formation exist in the state of Delaware along the Chesapeake basin. In fact, there are many parts of the country in which such shore conditions occur. Although the history of such sands has been tempestuous, they are for the most part, of relatively recent origin. They have been subjected to little surface pressure and may truthfully be called young.

The cut (Fig. 1) shows a magnified picture of Jersey sand which is quite white to the naked eye but, when passed over a mechanical shaker, separates into grains of pure quartz, grains of rutile, brookite, octahedrite (titanium oxide) and grains of ilmenite, which is an oxide of titanium and iron. Ilmenite is easily observable in practically all New Jersey sand on close examination. It is these tiny specks of other minerals than silica which are quite heavy in iron and so troublesome to the glass maker.

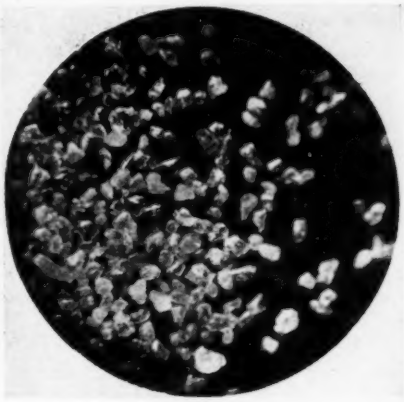


FIG. 1—GRAINS OF NEW JERSEY SAND, TYPICALLY IRRECULAR, PITTED AND MIXED WITH GRAINS OF ILMENITE. MAGNIFIED 15 DIAMETERS (15X)

THE ORISKAN SEA

In central Pennsylvania one sees outcrops of one of the oldest sand deposits in the United States. During the early part of the Devonian period an arm of the sea stretched from the northeast to the southwest, across western Massachusetts, eastern New York, through Pennsylvania, continuing into Maryland and West Virginia and Kentucky. This arm is called the Oriskan Sea. Following this, many tons of earth's crusts were subsequently deposited and finally subjected to the terrific pressure of the Appalachian uplift which produced the Appalachian mountains.

Picture a pocket handkerchief laid out flat, then pushed by pressure from the sides into ridges, then the tops of the ridges clipped off with scissors and you will have exactly the same effects illustrated as are shown by the exposed edges or outcrops of the Oriskan sandstone in the mountains of Pennsylvania. Naturally such sand deposits have been consolidated both by heat and pressure into a sandstone of much firmness. There are edges where the weather has partially reduced the deposits. At such points the sandstone is more or less friable. But for the most part sand from this region must be crushed before it is fit for industry. Such sand is consequently sharp in grain and quite free from the contaminations of formation to which the Jersey sands have been subjected.

Space does not permit a detailed description of the deposits of western Pennsylvania, where recrystallization has taken place under the lateral pressure of the Permian. Omitting also the description of the Toledo district of Ohio, we will pass to the north central portion of Illinois, where one finds deposits of sand of extraordinary purity and equally extraordinary physical characteristics. Examination of the cut made from a magnified photograph of grains from this field shows that they have smooth, rounded edges and that they are extremely free from contamination. So marked are these characteristics that one wonders what conditions could have produced such a sand.

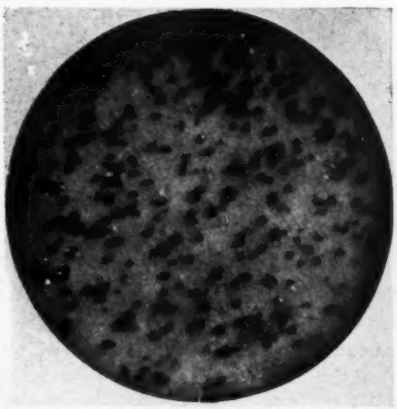


FIG. 2—THE ILMENITE AND RUTILE GRAINS ARE SHARPLY CRYSTALLINE AS COMPARED WITH THE ROUGH GRAINS OF QUARTZ SHOWN IN FIG. 1 MAG. 15X

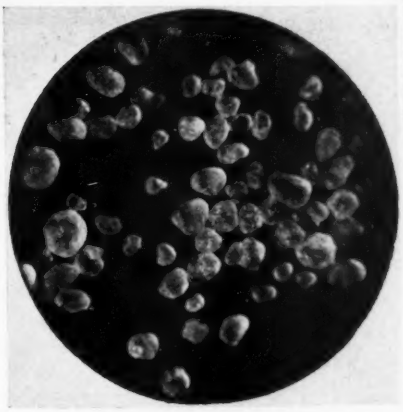


FIG. 5—THE "FORTUNATE" ILLINOIS SANDS WHICH HAVE BEEN TWICE SORTED BY WATER AND ONCE BY WIND. NOTE THAT THE GRAINS ARE SO ROUND AS TO BE ALMOST SPHERICAL. MAG. 15X

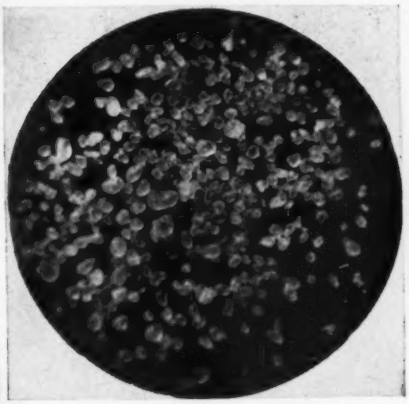
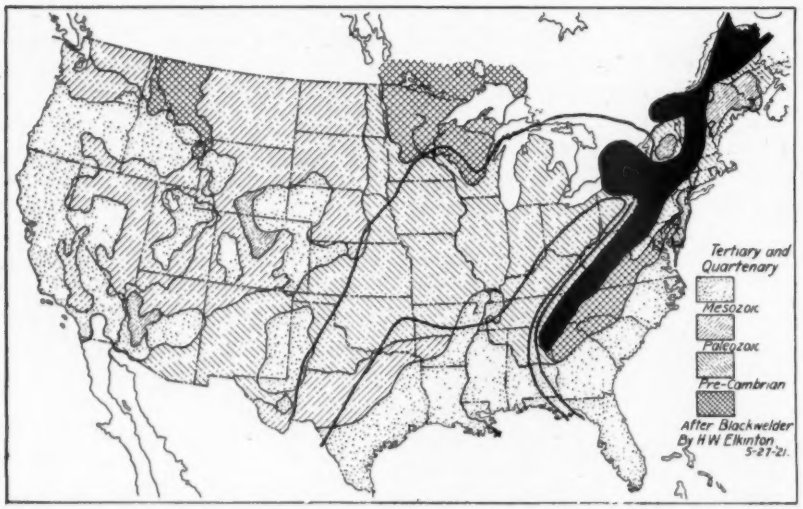


FIG. 4—TYPICAL MISSOURI GLASS SAND. THE GRAINS HAVE ROUNDED EDGES AND ARE HOMOGENEOUS. MAG. 15X

A glance at the map suggests that the waters of the Gulf of Mexico have been spilled off the United States, much as one might spill water off a great sheet. The geologist again takes us back over the countless years to the Ordovician age, when the interior of our country was for the most part a great inland sea. Reference to the map of the geologic periods will make this clear.

ST. PETER'S TIME

There was a period during this age when the inland sea extended from the middle of Kansas north to the middle of Michigan, east to southern Canada and south along the western edge of the Appalachian land. The period of the sea's greatest advance is known by the rather captivating



GEOLOGIC MAP OF THE UNITED STATES. THE BLACK AREA IS THE ORISKAN SEA. HEAVY LINES SHOW THE BOUNDARY OF THE ISLAND SEA OF ST. PETER'S TIME

name of St. Peter's time. Naturally, sandy stretches were laid down exactly as the sea creates sandy wastes on its shores today. In Illinois much sand was laid down at the time of the sea's greatest advance. The sea later retreated, withdrawing the shore edge from, roughly, the middle of Texas to the middle of Arkansas and extending obliquely to the southwestern corner of New York and south again along the barrier of Appalachia.

Wind Sorted Sands

This period is known to the rock reader as mid-St. Peter's time. It was during this period that the sand in the Illinois deposits is supposed to have been shifted by the winds, moved in dunes and subjected to a very thorough sorting.

We should remember that of the two kinds of mechanical sorting, washing and blowing, the latter is by all odds the most efficient. In blowing, large grains will quickly drop and fine grains will be carried much farther. In fact it is possible for the grains from a given dune to be separated by the wind a distance of many miles. In the same manner grains of quartz which have a different specific gravity from grains of feldspar or mica or other refuse minerals in the original beach, may be fanned by the wind and completely freed from their associates.

Washed and Sorted by Nature

But the Illinois region was even more fortunate, for the sea returned at the end of St. Peter's time to its northernmost border, so that a sand which was laid down by water was sorted by wind and again washed by water. As a result, the dust that is continually created by the moving of a dune was removed by a most opportune washing. The sand was thus left for man to use. But do not conclude from this that the sand does not have to be prepared for its use in the industries. Alas, it is in the bank and not in the manufacturer's bin. Even where she has done her best for him, Nature has had to leave a little work for the sand producer and the railroads.

This same deposit crops out in eastern Missouri and at other points along this ancient shore, although the Illinois deposit is by all odds the largest producing field.

Other Curious Deposits

There are several other curious and interesting deposits of glass sand. For example, take Lake Majella, in southern California, where a silica deposit was laid down by the diatoms which produce silica. This deposit is not of real sand but of diatomaceous earth. In Louisiana there are several deposits which are of much interest to the geologist. One, which is most unexplainable, is a deposit of exceedingly pure sand in the delta of Horn Island. It would be impossible to mention all of the hundreds of deposits in this country, but the best sand of glass making grade can usually be identified with one or the other of the deposits which have been mentioned. The character of the grain and the formation of the deposit can lead an experienced observer to pretty accurate conclusions regarding its origin, pedigree, and the way in which it was laid down.

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Glass Sand of the Middle Mississippi Basin, by E. F. Burchard.

Melting Precious Metals in a Glass Tube

How precious metals such as platinum or rhodium are melted in a tube of pyrex glass is described in a recent issue of the *Transactions of the American Electrochemical Society*. This article describes the work of R. P. Neville of the U. S. Bureau of Standards, Division of Metallurgy. The glass tube holds an alundum thimble which is coated with a powdered refractory material, such as thorium oxide. The latter does not melt until a temperature of 6,000° F. is attained.

The melting is done in an "Ajax-Northrup" high frequency induction furnace. In this furnace metals are heated or melted by electrical currents induced by a primary which consists of a water-cooled coil of copper tubing. The heat is not transmitted as such through the crucible or the glass tube surrounding it, but is produced within the metal itself. Because of the relatively thick layer of refractory around the metal and because the glass tube is next to the water-cooled copper coil, the glass is kept at a low temperature, except at the point where it is heated, by radiation from the surface of the treated metal supported in the open refractory crucible. For larger quantities of metal a fused silica tube is used. The melting of platinum or rhodium under this condition is accomplished in the absence of air. The greatest possible purity is thus insured for these metals.

The Testing of Glass for Practical Use*

By Dr. Friedrich Spaete†

(Concluded from the November issue)

VISCOSITY OF GLASS AT HIGH TEMPERATURES.—When glass, which at ordinary temperatures must be considered a solid liquid, is heated it begins to soften slowly and changes at high temperatures to a viscous and finally to a thin liquid. Glass does not have an actual melting point. It softens at different temperatures according to the chemical composition and also changes with different rapidity from a viscous condition to that of a thin liquid. The methods of testing the degree of viscosity are as follows:

1. A glass rod, which at one end carries a weight, is suspended in a vertical position in an electrically heated vertical oven. The elongation of the thread which occurs at a certain temperature and after a certain time is measured after passing a definite degree of temperature. The glass rod is three millimeters in diameter. It is made a little heavier at the top and bottom. The weight of about twelve grams is either melted directly in the rod or is suspended from a hook which is held by the glass. The oven consists of a porcelain tube, 6½ centimeters high and having an inside diameter of 5 centimeters. At the lower part of the glass rod a mark has been made which is sighted with a telescope against a millimeter scale. The temperature is measured with a thermocouple. Its junction and the glass rod should be as closely together as possible and in the center of the oven. The heating should proceed very slowly. Observations are made every minute.

2. Six to eight glass rods are suspended in the oven described above, one by one, and are heated to different temperatures. The weights must be melted directly into the bottom of the rods. The rods are supported by an arrangement which can be removed quickly. At a definite temperature the support is removed and the rod begins to lengthen. Observations are made as in method No. 1, to find how much time is required to obtain an elongation of 30 millimeters for each rod.

3. Polished glass cubes of 25 millimeters are placed in infusorial earth in such a position that the diagonal is vertical. The lower half dips into the infusorial earth. The cube is heated in an oven and kept at a definite temperature for a certain amount of time. The temperature at which the first impression on the polished cube is observed is noted as the temperature of deformation.

4. The procedure is as in method No. 3, only the conditions are such that the heating is continued until the pyramid emerging from the infusorial earth has melted until the sides and the point have disappeared. This is called the flow temperature.

5. In a vertical oven glass is melted in a platinum crucible, and the rapidity is observed with which a platinum weight sinks into the glass at different temperatures. A crucible of about 5 centimeters in height and with a diameter of 5 centimeters is used. The round elongated platinum weight weighs about ten grams. It has a hole at the top and hangs on a platinum wire of 0.2 millimeters in thickness. This wire runs over a small wheel and carries a counter weight of about four grams. The wheel has a pointer which moves over a scale. When the wheel is released the platinum weight sinks into the softened glass and moves the pointer. Thus it can be observed how rapidly it moves over the scale. The temperature is measured with a thermocouple. Its junction and the weight should be removed as far as possible from the sides of the crucible. By comparison with liquids of known viscosity Arndt has determined the absolute viscosity of glass by this method. For practical purposes it is usually sufficient to compare different glasses with one another.

THE APPLICATION OF THE VISCOSITY DETERMINATION IN PRACTICE.—From the above description it can be seen that in the first four methods the behavior of glass is studied during the temperature zone of softening. In the fifth method the behavior of glass in the liquid state is observed. If attempts are made to make a complete viscosity curve which includes the whole process of softening until the liquid state is reached, it is noticed that the curves obtained by the different methods do not meet, but that there is a temperature interval in which the viscosity cannot be determined according to the methods described. A method according to Vesely,[1] which cannot be described here, has been published but the author admits that the results are not accurate. Therefore, this method has not been tried out by the author. If an attempt is made to determine the viscosity curve in the unknown temperature zone, it is found that the different parts of the curve cannot be combined because the observations have been made under different conditions. The study of glass in the unknown temperature interval is of great interest for the comparison of two glasses, even if no continuous curves can be obtained. In any case, relative values are arrived at.

The first four methods yield only relative values, which are variable with the conditions. If uniform conditions are chosen, the same ovens and glass samples of the same dimensions and in methods Nos. 3 and 4 the same time of heating, standard conditions for the determination of viscosity are created. Only by method No. 5 is it possible to obtain absolute values. For practical purposes relative results are usually sufficient. The accuracy of all methods under the same conditions is very satisfactory. In methods Nos. 1 and 2 it is recommended to use glass rods which are not too thin. In rods of one millimeter diameter the deviations in size, which are inevitable, cause an appreciable error. Regarding method number 5 it is pointed out that in many glasses devitrification occurs during heating. The viscosity is then found to be too high. If glass becomes dull during heating, it must be heated to a higher temperature in order to clear it again. Or the crucible must be emptied and filled

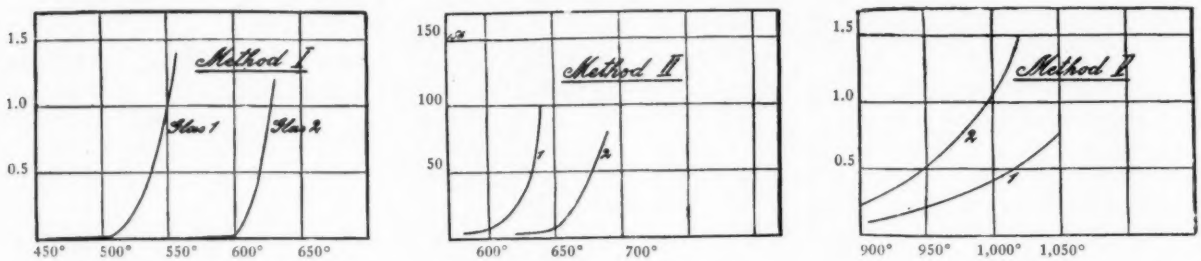
* From *Glastechnische Berichte*, published by the German Society of Glass Technology. Translated by J. B. KRAK, Technical Editor of THE GLASS INDUSTRY.

†Director of Research, Osram Works, Berlin.

(1) V. Vesely. On the viscosity of glass. *Sprechsaal* No. 30, 1911, 9. 411.

anew. It is necessary to maintain the right conditions most carefully and to have good control of the temperature throughout the experiment.

The study of glass by the first four methods, that is, during the heating, the softening temperature and during further heating, is especially important for glass which has to be lampworked. Also for glasses which are to be joined together and finally and especially for glass which is heated and must keep its shape. This is important for the proper management of lehrs. When the softening temperature is known, the temperature of the lehr can be kept at



such a point as to avoid deformation or the melting together of the glass objects. For the management of glass melting ovens the degree of mobility of the glass at high temperature is especially of interest, for on it depends the degree of workability. Glass must have such a consistency that it can be worked well. At the same time it should not harden too quickly.

Accurate knowledge of the fluidity at different temperatures is especially needed for the successful working of glass by machinery. If the viscosity of glass at different temperatures is known it is possible to increase the output of each machine considerably by keeping the temperature accurately at a definite degree. Of equal importance is a knowledge of the influence of the composition on the toughness. For instance, for certain machines no glass can be used which hardens very slowly. On the other hand, if one has knowledge of the temperature which corresponds to the best workability, it is easy to bring the oven to that temperature by proper control. How important, for instance, is an accurate knowledge of the temperature-viscosity curve and its dependence upon the composition of glass in the mechanical production of window glass. The glass blower has more or less control of the working of the molten glass, and can treat each kind individually. The machine, on the contrary, works the glass in a purely mechanical way, without judgment, and it is therefore important to produce glass which can be worked to the best advantage. Only then is it possible to obtain the highest production.

It is impossible to calculate the viscosity from the chemical composition. It is known from experience that silica increases the toughness of glass, alkali and boric acid render it more fluid. Alumina and lime speed up the hardening process. Here also the mutual interaction of the components play an important part. Positive experience on this complicated subject is as yet very vague, and it would be very desirable to undertake systematic research in this field.

In the curves above the results of the viscosity tests of two glasses are represented. Their analyses cannot be given here. In curve "Method I" sharp breaks can be observed which indicate the temperatures at which the glasses change from the hard to the plastic state. In the curves of "Method II" other conditions have prevailed. If the same conditions had prevailed in both methods the two curves would fit together almost perfectly. It can be seen that according to Method II it is possible to study glass at almost 100 degrees higher temperature than in Method I. In the curve "Method V" it may be observed that both curves diverge considerably at higher temperatures. Also that glass 2, which has a much higher softening point than glass 1, becomes much more fluid when once the liquid state has been reached than glass 1.

In most glasses, especially those belonging to the same type, the softening temperature corresponds to the degree of fluidity at higher temperatures. The examples mentioned are interesting proof that from the comparison of two glasses, with regard to their behavior during softening, no conclusion can be drawn with reference to their behavior at higher temperatures. If a continuous viscosity curve of these two glasses could be made a crossing point should exist lying in the intermediate zone which has as yet not been studied. It is interesting to observe that the curves diverge considerably at increasing temperatures; in other words, that glass 2 becomes a thinner liquid much faster than glass 1.

The above endeavors to give a short description as to how the properties of glass can be tested. Many points have not been mentioned, which are also of importance in practice; for instance, the tendency to devitrify, the electrical conductivity, and many other questions. From the above descriptions it should be apparent how important it is for the glass industry not to proceed along purely empirical lines, as is often the case at present, but to work on a scientific basis and to become independent of chance.

Effect of Sea Water on Glass

Some work was carried out recently on the effect of sea water on various types of glass, to determine the best kind to use for the lenses of signal lights on shipboard. From the data which the Bureau of Standards has secured, the damage which these lenses often suffer appears to be caused by the evaporation of sea spray, which leaves a deposit of salt on the surface of the lens. This eventually etches the glass. Three types of glass, boro-silicate, lead glass, and ordinary soda-lime glass, have thus far been investigated. Under the conditions of the test, lead glass etched considerably, while the other two did not.—*Technical News Bulletin, No. 78.*

Combustion Control and Furnace Design

By G. W. Akerlow*

(*Concluded from the November issue*)

THEORY OF HEAT AND HEAT OF COMBUSTION. Up to the time of the experiments of Rumford, Davy and Joule heat was thought to be a fluid that could flow from one body to another, and thus cause the temperature of the body to change. The experiments above referred to invalidated this theory, and now heat is assumed to be a form of energy, which may be converted in exact quantitative relations into other forms of energy. According to the modern mechanical theory of heat, the molecules of a body are supposed to be in a state of vibration, the vibrations being greater for the higher temperatures, and less when the temperature is lower. If a cool body is placed in communication or contact with a hotter body, the temperature or the molecular vibrations of the cool body will be increased while those of the hot body will be decreased. This interchange will continue until both bodies have assumed the same temperature.

Heat may be generated by the expenditure of mechanical work, for instance in the case of friction by the dissipation of electricity, as for example in the case of the glowing wire in the incandescent lamp, or by chemical reaction as, for instance, in combustion. On the other hand, by expending heat energy useful work may be accomplished, an example of which we see in the steam engine.

Temperature is expressed in degrees, which are subdivisions of the temperature range from boiling water to melting ice. The instruments used to measure temperatures are called thermometers, the graduations of which may be in accordance with any of the three scales, namely, the Fahrenheit, Centigrade or Celsius, and the Reaumur. Of these the Fahrenheit scale is mostly used in this country, while the centigrade scale is used for scientific work. The conversion from one scale to that of another may be done by using the equations given below:

Fahrenheit = 32 + (Centigrade × 9/5)
Fahrenheit = 32 + (Reaumur × 9/4)
Centigrade = (Fahrenheit − 32) × 5/9
Centigrade = Reaumur × 5/4
Reaumur = (Fahrenheit − 32) × 4/9
Reaumur = Centigrade × 4/5

The different scales are based upon the following data:

TABLE 4

Explanation	Degrees Fahrenheit	Degrees Centigrade	Degrees Reaumur
Freezing Point	32	0	0
Boiling Point	212	100	80
Difference	180	100	80
Ratio of Difference	9	5	4

In order to facilitate the comparison and calibration of temperature scales the Bureau of Standards has determined the fixed points shown in Table 5.

Instruments for measuring temperatures are classified by J. A. Moyer in Table 6, which also gives the temperature range and degree of accuracy usually obtained.

TABLE 5

Substance	Deg. F	Substance	Deg. F
Naphthalene boils at	424.4	Gold melts at (in CO_2)	1944.3
Benzophenone boils at	582.5	Copper melts at	1980.7
Cadmium melts in air	609.4	Lithium metasilicate	2193.8
Zinc melts in air	786.7	Diopside, pure in air	2562.2
Sulphur boils at	832.0	Nickel melts in H_2 or N_2	2645.6
Antimony melts in CO_2	1165.6	Cobalt melts in H_2 or N_2	2713.6
Aluminum solidifies in CO_2	1273.3	Palladium melts in air	2820.6
Silver melts in CO_2	1760.0	Anorthite melts in air	2821.1
		Platinum melts in air	3186.0

The intensity of heat is measured by thermometers but the quantity of heat to produce this intensity is measured by another unit, namely, the British thermal unit, which is commonly written B. t. u. Above, it was mentioned that by

TABLE 6

Type	Range temp. F.	Accuracy degrees F.
1. Mercury thermometers		
(a) Ordinary type	− 38 to + 575	From 1.0 to 0.01
(b) Jena glass, capillary tube filled with nitrogen	− 38 to +1000	Higher ranges accurate to 1 deg.
(c) Quartz glass capillary tube filled with nitrogen	− 37 to +1500	Higher range to 1 deg.
2. Alcohol or petrol-ether	− 325 to + 100	Accurate to 1 deg.
3. Electrical resistance	− 400 to +2200	Accurate to 0.01 deg. for range of 0 to 500 deg.
4. Thermo-electric	− 400 to +3500	Reliable to nearest 5 deg.
5. Metallic expansion, mechanical	+ 300 to +1000	Uncertain
6. Vapor	+ 95 to +1350	Reliable to from 2 to 10
7. Radiation		
(a) Thermo-couple in focus of mirror	+ 300 to +4000	Reliable to nearest 20 deg.
(b) Bolometer	− 400 to temp. of sun.	Reliable to nearest 20 deg.
8. Optical	+1100 to temp. of sun.	Reliable to nearest 20 deg.
9. Seger cones	+1100 to +3600	Reliable to about nearest 20 deg.

expending mechanical work heat would be produced, on the other hand by expending heat we can produce work. The relationship between work done and heat is expressed by the mechanical equivalent of heat which has been firmly established to be equal to 778 B. t. u. to one foot-pound. The B. t. u. has been determined to be that amount of heat required to raise the temperature of one pound of water from 39 degrees F. to 40 degrees F. The temperature range from

*Mechanical Engineer,

39 to 40 has been chosen because water has its greatest density at this temperature. However, in practical work the mean B. t. u. has been adopted as a standard and this mean heat unit is 1/180th of the heat required to raise the temperature of a pound of water from 32 to 212 degrees F.

The heat contained in a body is a function of its mass, its temperature and its specific heat, or heat capacity. The specific heat of a substance is the amount of heat required to raise the temperature of it one degree. The specific heat of water is therefore 1 B. t. u. The specific heat of all other substances express their capacity as compared with water. The greater the specific heat of a substance the more heat is required to increase its temperature through a given range, and the more heat it will give up when cooled. The specific heat of a solid body can be determined by heating it and immersing in water. The heat lost, as determined by the increase in temperature of the water, divided by the mass of the body and its decrease in temperature, gives the specific heat. For solid bodies and liquids the specific heat is practically constant, varying but slightly for different temperatures. In the case of gases, however, the specific heat varies considerably for changes in temperature.

A knowledge of the specific heat of gases is of great importance in the calculation of combustion data. The heat of combustion of any substance has an important bearing upon the temperature developed from the burning of such substance. As noted above, the specific heat for gases varies considerably for changes in temperature, and the reason for this will be evident when one considers the pressure-temperature-volume relation that exists and which was pointed out in the foregoing. When heat is added to a gas, its volume may be kept constant, and in this case no external work is performed; or the gas may be allowed to expand with its pressure kept constant. The specific heat of the gas will be less when the volume is constant than when the pressure is kept constant. The difference between the two will be the amount of heat required to do the work of expansion against the external pressure. The range of pressures of gases encountered in furnace work is very limited, so much so in fact that it is common practice to assume the pressure to be constant. The temperature variations, however, are very wide and naturally the volume will vary. The specific heat of gases may be still further classified as being instantaneous or mean. The instantaneous specific heat is the amount of heat that must be added to a unit weight of such substance at some definite temperature to increase its temperature one degree, under given conditions of pressure or volume. The mean specific heat, over a given temperature range, is the value by which such range must be multiplied to determine the quantity of heat necessary to raise the

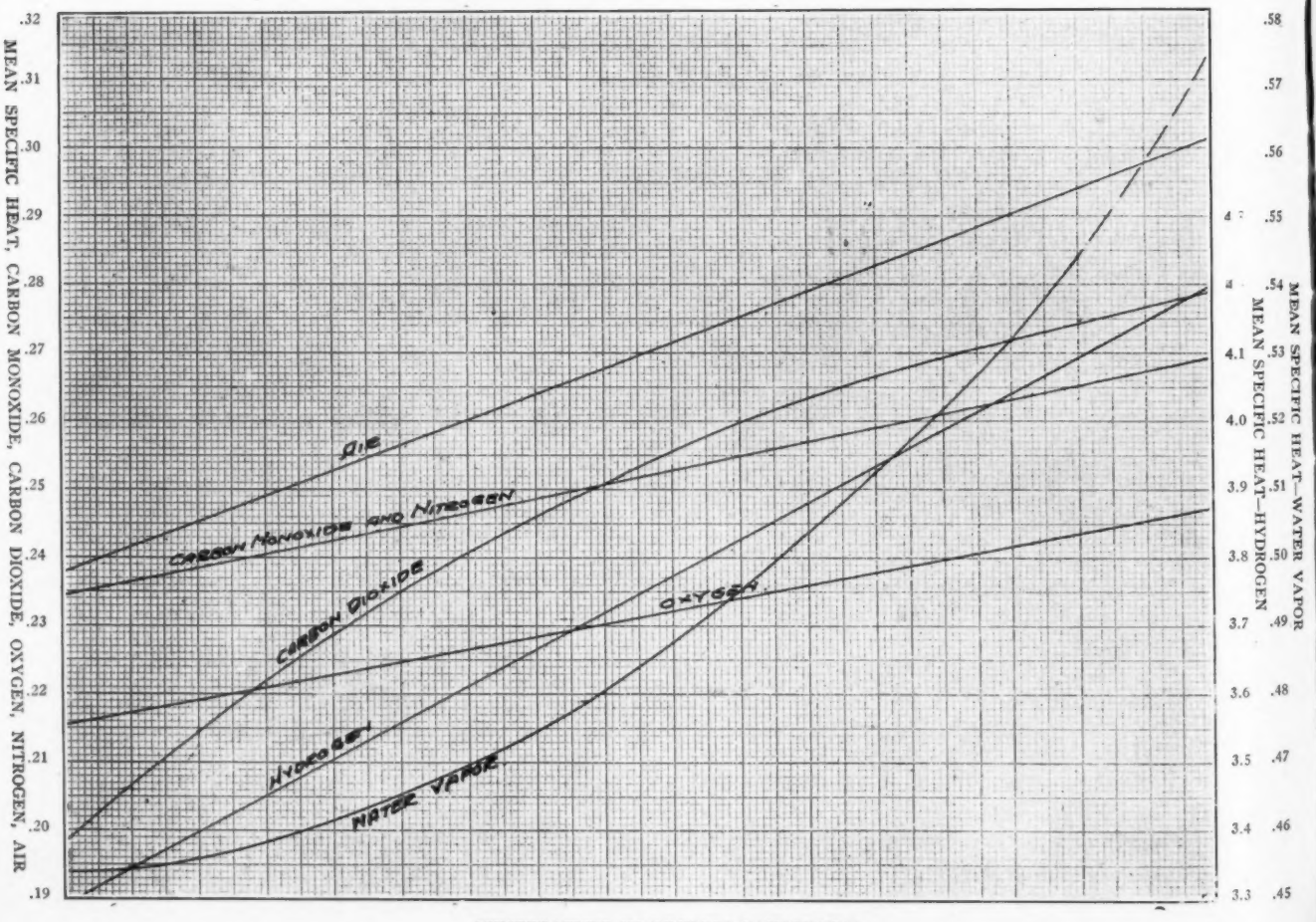


FIG. 1—MEAN SPECIFIC HEAT OF VARIOUS GASES.

unit weight of the substance through the range under the conditions of pressure or volume that may exist. The mean specific heat is always used in calculating combustion data.

There is considerable disagreement between the values for the specific heat as determined for the same gas by different investigators. Below is given a set of formulas for the calculation of the specific heat of the gases commonly encountered. These formulas were originally worked out by Holborn and Henning, but have been slightly modified in order to give logical results at particularly the higher temperatures. The specific heat of the different gases has been plotted on the graphic chart, Fig. 1, for a temperature range of 0 to t degrees Fahrenheit.

Carbon dioxide: For temperatures up to 2200 deg. F.:

$$c_p = 0.1983 + 417.5 \times 10^{-7}t - 5.567 \times 10^{-9}t^2$$

For temperatures above 2200 deg. F.:

$$c_p = 0.1991 + 436.5 \times 10^{-7}t - 7.8 \times 10^{-9}t^2 + 5.5 \times 10^{-13}t^3$$

Carbon monoxide and Nitrogen:

$$c_p = 0.2343 + 0.0000105t$$

Oxygen: $c_p = 0.2154 + 0.0000095t$

Hydrogen: $c_p = 3.29 + 0.000266t$

Water Vapor: The formulas for calculating specific heat of water vapor are based upon the Marks and Davis' Steam Tables:

$$c_p = 0.4541 + 16 \times 10^{-7}t + 942 \times 10^{-11}t^2$$

Methane: $c_p = 0.481 + 0.00028t$

Ethylene: $c_p = 0.335 + 0.00021t$

When a compound is formed or decomposed, the resulting chemical action causes a change of the energy supply of the reacting substances. This change in the energy supply evidences itself by an evolution or absorption of heat. The caloric effect for a great number of substances and their combinations have been measured, and it has been found that the same amount of heat that is evolved in the formation of a compound will be absorbed when decomposition of the compound takes place. The principles that govern the combination of, for instance, a combustible and oxygen and the attendant evolution of heat are those propounded by Berthelot and generally known as his "second law." This law reads about as follows: The heat energy developed in any chemical change, when no work is performed, that is through the combination of a combustible element with oxygen, is dependent upon the final products of combustion and in no way upon any intermediate combination that may have occurred in reaching the final result.

As an illustration of this law, let it be assumed that we have a furnace with a fuel bed about six inches thick. The oxygen enters this bed under the grate. At a point about 3½ inches from the grate all of the oxygen in the air has been used up and at the same time the carbon dioxide has reached a maximum of, say, 12 per cent. Beyond this point the percentage of carbon dioxide drops, and the percentage of carbon monoxide and other combustible gases increases very rapidly. This shows that the dioxide is reduced to the monoxide by coming in contact with the hot coal. At the surface of the bed the gases contain about 26 per cent of combustibles, no oxygen, and about 8 per cent carbon dioxide. If sufficient air is added the combustion will be completed and the full amount of heat developed, otherwise not. From the above it is evident that although the chemical combination was completed at a point 3½ inches from the bottom of the grate and all the heat of this combination was evolved, the combination was again broken down, some of the heat again absorbed and the final result was gases that could be further burned and had considerable heat value.

The best method of determining the heat value of any fuel is the direct burning of the fuel in a "bomb calorimeter." However, for the use of gaseous fuels another type of calorimeter must be used, the accepted standard for this being the Junkers. The accuracy of the determination is largely a matter of skill in manipulation and the personal equation.

TABLE 7

Substance	Symbol	Heat Value—B.t.u. per pound at 32° F. before and after combustion: Higher	Lower Net	Lower heat Value per cu. ft. in B.t.u. at 60° F. and 14.7 lb. pressure
Hydrogen	H_2	62100	52230	277
Carbon to CO	C	4380	4380	....
Carbon to CO_2	C	14540	14540	....
Carbon monoxide	CO	4380	4380	324
Methane	CH_4	24000	21520	917
Acetylene	C_2H_2	21860	21100	1483
Ethylene	C_2H_4	21900	20480	1542
Ethane	C_2H_6	22340	20350	1671
Sulphur to SO_2	S_2	4050	.....	....
Sulphur to SO_3	S_2	5940	.....	....

In Table 7 is given the heat value for a number of substances that can be termed pure fuels.

The heat of combustion may be defined as the amount of heat liberated by combustion at atmospheric pressure, the combustible being initially at 32 degrees F. and the products of combustion reduced to the same temperature, all water of combustion being condensed. The heat of combustion thus defined is called the *higher heat value,* and includes the amount of sensible heat actually added to the products of combustion, as well as an amount of latent heat which exists as potential energy in the steam formed. That is to say, only a portion of the total calorimetric heat of combustion, called the *lower heat value,* is liberated by the chemical reaction and goes to heat the products of combustion. The other portion is due to the difference between the amount of heat required to heat the combustible from 32 degrees F. to the ignition point and the amount of heat liberated when products of combustion are cooled from the ignition point to 32 degrees F. If the combustibles are all gaseous, this latter amount of heat is greater than the former by the latent heat of condensation of the water, and the difference between the heat of the water from 32 degrees to 212 degrees and the heat of the same weight of gas between the same limits. This is due to the fact that the specific heats of the combustibles and the products of combustion are nearly equal so long as both are gaseous. Or in other words, the measured heat of combustion, if the combustibles and products of combustion are brought to the same temperature, will be the same for all temperatures over 212 degrees.

The lower heat value is in common use in Great Britain and in most foreign countries. In the United States the higher heat value is almost universally accepted, and this is the standard adopted by the American Society of Mechanical Engineers. When the lower heat value is used it introduces a source of possible error in the computation; for this reason the higher heat value should always be used.

.58 .57 .56 .55 .54 .53 .52 .51 .50 .49 .48 .47 .46 .45

MEAN SPECIFIC HEAT—WATER VAPOR
MEAN SPECIFIC HEAT—HYDROGEN

The Glass Industry

The First Technical Trade Journal Devoted Primarily to Glass Technology, Engineering, Raw Materials, and Glass Factory Equipment and Operation.

Published Monthly by the
GLASS INDUSTRY PUBLISHING COMPANY, INC.
50 Church Street, NEW YORK

Telephones { Cortlandt 2465 / Cortlandt 5618 — Cable Address, Glasdustry

J. B. KRAK, Technical Editor

Subscription Price.....$2.00 a Year
Single Copy.....20 Cents

THE GLASS INDUSTRY circulates extensively among American and foreign glass manufacturers, their business executives and technical and factory operating staffs.

ADVERTISING RATES SENT ON REQUEST

Vol. 4 NEW YORK, DECEMBER, 1923 No. 12

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CLASSIFIED BUYERS' GUIDE, PAGE 16

Readers of THE GLASS INDUSTRY in the United States and elsewhere are requested to favor the Editor with any information available from time to time concerning developments in their own or other fields which would be of general interest to the industry. Authoritative facts about new glass manufacturing projects, re-organizations, new factory construction, new processes and equipment, raw materials, manufacturing and market conditions, personal items, and other appropriate subjects would be welcomed.

Those experienced in the practical, technical or executive activities of glass manufacturing who are qualified and willing to lend their aid to the upbuilding and progress of the industry by giving from their store of knowledge to others, are invited to submit for publication articles on any subjects relating to glass which would be of interest and value to our readers. The authors of accepted articles of this kind will be compensated at regular rates.

Tax Reduction

Among the conspicuous services which the late President Harding has rendered his country none is greater than his successful policy to bring conditions "back to normalcy." As a direct consequence of his efforts we have the recent announcement from Secretary Mellon stating that it will be possible to lighten the burden of taxation by more than three hundred millions of dollars. It is certain that nothing could do more to restore permanent prosperity than the gradual lowering of the excessive taxation which has been such a dead weight upon industry and commerce. The National Industries Council is of the opinion that a trade boom is certain to follow the carrying out of Mr. Mellon's program, and that it will prove to be the greatest stabilizing event since the conclusion of the war. With this we feel sure that glass manufacturers will agree heartily.

It would seem that the adoption of the tax reduction proposals, endorsed as they are by the vast majority of people, would be an easy matter. However, the practical politicians in Congress will have to be reckoned with. If Congressmen can be given to understand that the administration which reduces taxes will win the support of the majority of the voters at the next election, they will not forego the advantage which can be gained by aiding to bring about the return of normal conditions.

Reasons for Adopting Metric System

The following arguments in favor of the adoption of the metric system were compiled by a committee of the Chamber of Commerce of the United States:

1. The metric system of weights and measures is now firmly established as an international system, either through its legal adoption, or its exclusive or permissive use for standards, by the principal nations of the world. Its more general use in the United States is therefore advocated to promote greater international uniformity, and in the hope, if that be accomplished, that other English-speaking peoples would follow the lead of this country.

2. The system has been proved to be satisfactory in the United States and elsewhere in its use in complicated scientific calculations; and, in the metric countries, adaptable to the everyday trade, and to industrial and educational requirements of the people.

3. While the basis for the units of the metric system is, of course, arbitrary, it has now been definitely established, and the various decimal gradations give a wide choice for convenient designated measurements of length, weight and capacity, adaptable to common and scientific use. Familiarity with such terms as the pound and inch is largely a matter of habit, and it is believed that habit would also make the use even of the decimal subdivisions of the metric system, such as the millimeter, equally familiar and convenient.

4. The basic simplicity of the system, with its few units, as the meter, liter, gram, with decimal subdivisions, makes both teaching and learning easy; and, in trade, makes billing and computation simple. During the period of transition, when there would for a time be more active dual relations than at present, conversion would be almost automatic through the use of tables of equivalents.

5. An arbitrary imposition of any system of weights and measures, without a reasonable period of transition or the principle of exemption, where desirable for manufacture or for export to nonmetric countries, might be a hardship. A gradual change has been effected in most metric countries, and it is believed that such change was accomplished without hardship and without such heavy expense as claimed by those opposed to its adoption. It is also believed that greater conformity to the habits of metric countries would tend to increase

our export trade. The question of countervailing imports of manufactured goods and raw material is an economic subject quite apart from the question at issue.

6. The relative international popularity of the two major systems in use is shown by the number of nations which in recent years have adopted the metric system, while none has formally adopted the British-American system, although in population the two groups are about equal. [Since 1914, Poland, Latvia, Russia, Japan, Haiti, and Estonia have become metric.]

Technical Consultation Service

THE GLASS INDUSTRY invites its readers to refer to this department any problems with which they may be confronted pertaining to raw materials, glass technology, laboratory and factory practice. While making no pretensions to the possession of unbounded knowledge or infallibility THE GLASS INDUSTRY is ready to assist its readers to the best of its ability in solving their problems. Readers who can offer better suggestions are invited to submit them.

Questions should be submitted in writing and will be answered by mail as promptly as possible. The sources of all inquiries will be held in strict confidence.

Question 55. Window Glass Batch. We have been using the following window glass batch:

Sand	2,000 lbs.
Limestone	704 lbs.
Carbonate of soda	548 lbs.
Salt cake	145 lbs.

The analyses of the raw materials are enclosed herewith. This batch has not worked satisfactorily and we are contemplating making a change by taking off 15 lbs. of soda, making the soda 533, and adding 21 lbs. of salt cake, making the salt cake 166 lbs., with the idea that it will give us a somewhat better working batch. We will also add about 1 lb. to 1½ lbs. of coal to the new batch.

We would like to have your opinion as to the effect of this change and whether you consider this a good window glass batch or not.

Analyses of raw materials:

SAND

Silica	98.17
Iron and alumina	1.75
Moisture	.056
Undetermined	.024
	100.00

SODA

Sodium carbonate	99.8
Sodium chloride	.50
Sodium sulphate	.11
Insoluble	.05
Calcium carbonate	.10
Magnesium carbonate	.06
	100.62

SALT CAKE

Sulphate of soda	97.15
Free acid	1.30
Sodium chloride	1.05
Silica	.25
Iron	.25
	100.00

BEDFORD LIMESTONE

Alumina	.36
Magnesium oxide	.86
Loss on ignition	43.56
Iron oxide	.06
Calcium oxide	53.55
Silica	1.31
	100.00

Answer.—Regarding your inquiry it would have been a considerable aid if the glass analysis had been included. Only from the actual analysis of the finished product can it be judged whether a change in the batch is desirable or not, and what this change should be. Since only the batch and the analyses of the raw materials have been given it has been necessary to calculate the glass analysis. This, of course, is not an accurate procedure. For instance, it is impossible to account for the amount of volatilization which takes place during melting as it is different for each furnace.

BATCH		On basis of 100 lbs. sand		Glass	Percentage Composition
Sand	2,000	100	SiO_2	98.64	71.42
Limestone	704	35.2	Fe_2O_3 } Al_2O_3 }	1.77	1.28
Soda ash	548	27.4	CaO	18.85	13.65
Salt cake	145	7.3	Na_2O	18.84	13.65
	3,397	169.9		138.10	100.00

The results given above have been arrived at by a method of computation described in Volume 2, No. 7, pp. 159-160, July, 1921. A loss of 2 per cent alkali has been assumed.

PROPOSED BATCH					
Sand	2,000	100	SiO_2	98.64	71.24
Limestone	704	35.2	Fe_2O_3 } Al_2O_3 }	1.77	1.28
Soda ash	533	26.6	CaO	18.85	13.62
Salt cake	166	8.3	Na_2O	19.19	13.86
	3,403	170.1		138.45	100.00

You do not state in what respect the glass is unsatisfactory. If breakage is excessive and if numerous and large blisters occur it would be advisable to increase the amount of limestone from 704 to 724 lbs. This would give a batch and glass approximately as follows:

SUGGESTED BATCH		On basis of 100 lbs. of sand		Glass	Percentage Composition
Sand	2,000	100	SiO_2	98.65	71.15
Limestone	724	36.2	Fe_2O_3 } Al_2O_3 }	1.77	1.27
Soda ash	548	27.4	CaO	19.39	13.99
Salt cake	145	7.3	Na_2O	18.84	13.59
	3,417	170.9		138.65	100.00

We can see no advantage in changing the batch as you propose to do. As a matter of fact we should prefer to continue to use the old batch rather than increase the amount of alkali, unless the tank shows scum formation. In that case it may be of advantage to substitute some salt cake for soda ash. However, it seems unlikely that scum would be formed using any of the batches discussed.

In case you notice any improvement in the glass—should you desire to follow our suggestion—it would be perfectly safe to add another 10 lbs. of limestone.

We feel that we are at a distinct disadvantage having to discuss this matter by letter and with the limited information at our disposal, and we trust that you will consider this in making your decisions as to changes in the batch.—J. B. K.

Specifications for Glazing Glass

Progress has been made in the preparation of specifications intended to be adopted as standard for plate, wire, window and processed glass, rolled figured sheet, ornamental and prism glass, on which task the staff of the Bureau of Standards in connection with the Federal Specifications Board and in cooperation with glass manufacturers has been engaged for some time past, but according to a very recent statement by Dr. George K. Burgess, Director of the Bureau, these specifications have not yet been adopted.

For some time the Bureau has been investigating the breaking strength of sheet glass. The results obtained by breaking sheet glass in frames have been computed, and a comparison of these data shows, in the case of the uniform hydraulic loading of glass over its entire area, that the thickness has considerable effect upon the strength obtained.

Thin glass gives a strength which is quite high in proportion to its thickness. This strength decreases rapidly with decrease in thickness, determinations having been made for glass from 1/10 to ¼ inch thick. Glass, when tested in frames and loaded in the center, shows a strength almost comparable with that which it would exhibit if acting as a beam supported on two ends only.

The results above described were obtained using a single size of sheet.

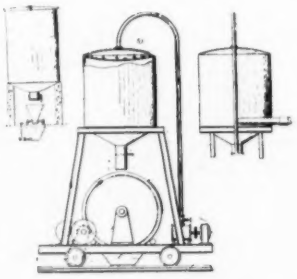
Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Copies of United States Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

Raw-Material Conveyer for Feeding Glass Furnaces. U. S. 1,473,008. Nov. 6, 1923. Wilbur F. Brown, of Charleston, W. Va., assignor to the Libbey-Owens Sheet Glass Company, of Toledo, O.

This invention relates to a new and improved conveyer for feeding the raw materials to glass tank furnaces, and relates more particularly to an apparatus for pneumatically conveying the raw materials comprising the glass batch from the storage bins or tanks and delivering them to the glass melting furnaces.



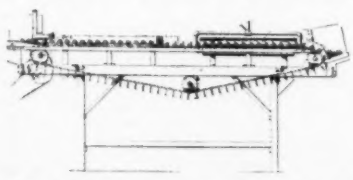
The object of the present invention is to provide a system for delivering these raw materials to the furnaces by suction. A single pipe line feeds all of the materials to all of the furnaces, and a single blowing and mixing unit is used interchangeably for any of the furnaces.

This apparatus provides a means for quickly and cleanly delivering the batch materials to the furnaces. The materials travel through the pipe at a high rate of speed, which cannot be attained with any other type of conveyor. Very little labor is required, one attendant at each end of the system being sufficient. Also, a very thoroughly mixed batch is obtained, since the mixing is done after the materials have been transported to the furnace. The mixed batch is delivered bodily, directly into the hopper which feeds the furnace, thus leaving no opportunity for segregation of the constituent materials.

Among other claims of the inventor is a combination with a series of raw material tanks and a series of glass furnaces, of a conveyor pipe extending adjacent all of the tanks and furnaces, a weighing device below each tank, a hopper in communication with the conveyor pipe for receiving the raw material from the weighing device, a valve between each hopper and the conveyor pipe, a glass batch hopper for each furnace and means for delivering the batch from the hopper to the furnace, a car movable above the line of batch hoppers and parallel to the conveyor pipe, a receiving chamber on the car, valved means for connecting the chamber in receiving communication with the conveyer pipe when the car is positioned over any batch hopper, a blower on the car for drawing materials by suction through the pipe into the chamber, and a material-mixer on the car below the chamber, the mixed materials or batch being delivered from the mixer into the batch hopper.

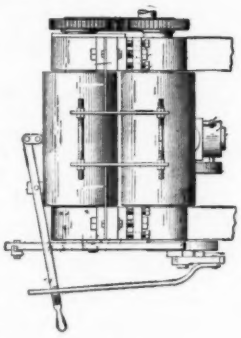
Glazing Machine. U. S. 1,473,675. Nov. 13, 1923. Hans N. Halversen, of Vineland, N. J., assignor to Kimble Glass Company, of Chicago, Ill.

The inventor claims in a glazing appliance the combination of two heating means positioned to successively heat the opposite ends of the bodies treated, a guide-plate for each of said heating means, a support having portions sloping in opposite directions toward said guide-plates, and a pair of parallel endless conveyor chains equipped with forwardly-bent fingers to engage and roll the inclined bodies to be glazed along said support first with one end against one guide-plate and the opposite end subject to the action of the corresponding heating means, and subsequently with the glazed end against the second guide-plate and the other end in a position to subject it to the action of the second heating means, said support and bent fingers maintaining in each instance the end being glazed in advance of the end bearing against the guide-plate, substantially as described.

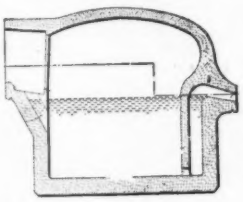


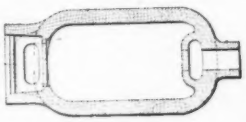
Process and Apparatus for Producing Spectacle Blanks. U. S. 1,471,725. Oct. 23, 1923. Frederick Gelstharp, of Tarentum, Pa., assignor to Pittsburgh Plate Glass Company.

The invention relates to a process and apparatus for producing spectacle blanks. It has for its principal objects the provision of an improved process and apparatus, (1) whereby the blanks may be produced more rapidly and economically than by the methods heretofore practiced, (2) whereby the blanks may be punched from a glass sheet in a plastic state and pressed to the desired curvature at a single operation, and (3) in which the blanks may be produced continuously with a minimum amount of waste and with a relatively high percentage of usable blanks.



Glass-Melting Pot. U. S. 1,471,824. Oct. 23, 1923. Clinton A. Bowen, of Corning, N. Y., assignor to Corning Glass Works, of Corning, N. Y.



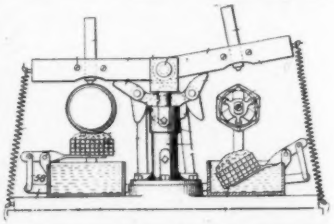


The improved device is constructed in one single mass of the refractory material usually employed in manufacturing melting pots for glass and for similar purposes, and comprises a body portion with a bottom, vertical walls and dome-like top. The improved body is designed to be located within the furnace in the usual manner.

The device is particularly designed to be used in connection with a continuous tube-drawing apparatus, and in actual practice the glass is led by means of a trough onto the rotating spindle of such apparatus.

Glass-Banding Machine. U. S. 1,473,762. James Boyd Greer, of Pittsburgh, Pa.

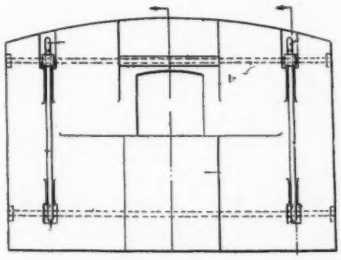
A special object of the invention is to provide a machine which is capable of cutting various designs of bands by the mere substitution of suitable cutting elements, the entire cutter being removable as a unit so that a change from one design to another may be made in a minimum period of time, which cutter may be accurately adjusted while removed from the machine, thus preventing a shutting down of the whole machine for such purpose. Other objects are to provide a bander having a plurality of independently operating cutter carrying arms which automatically accommodate themselves to irregularities in the



article being cut and which may be used either singly or in multiple, and to provide means on the chuck co-operating with the arms so that adjustment may be made to cause the arms of the several chucks, whether on the same machine or on a similar machine, to contact the article being cut at corresponding points.

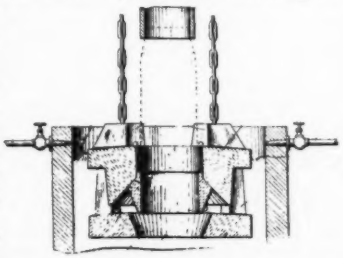
Door for Glass-Pot Furnaces. U. S. 1,469,358. Oct. 2, 1923. Charles H. Christie, of Butler, Pa.

The furnace door comprises a body portion of refractory material and longitudinally extending metal rods embedded in said material adjacent the top and bottom thereof, the door having a charging opening and a recess formed above said charging opening, across which the upper of said rods extends and a protecting covering for said rod where exposed at said recess, said rods being exposed at, or near, their ends, and upright rods engaging said longitudinally extending rods at their exposed portions, and a pipe surrounding said rod where exposed at said recess.



Glass Machinery, U. S. 1,471,002. October 16, 1923. Andy Parys, of Mount Vernon, Ohio.

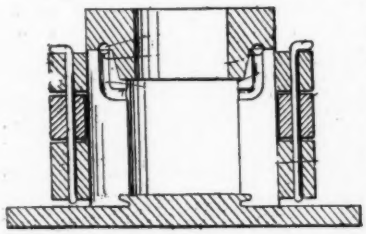
This invention has for its primary object the provision of apparatus whereby the successive dipping of a drawing or blowing tube into a body of molten glass may be expeditiously accomplished without diminution in the rapidity of operation of the apparatus due to the removal or skimming of congealed glass incrustation from around the walls of the openings.



It comprises a pair of separable dipping and shaping sections formed from a refractory material and capable of floating upon a body of molten glass positioned within a tank, said sections being provided with vertically disposed dipping openings, situated in alignment and capable of receiving a roll drawing pipe.

Glass Mold. U. S. 1,474,329. Nov. 13, 1923. John G. Moritz, of Glassport, Pa.

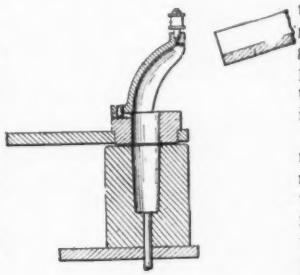
The object of the invention is to provide means whereby the handle of a glass receptacle such as a basket may be molded simultaneously and in connection with or attached to the body portion of the article and may be made of any preferred design suited to that of the body of the receptacle while permitting of the opening of the mold for the removal of the article as soon as the plunger and cap or ring have been withdrawn from the body portion of the mold. What is claimed as new and useful is:



A molding apparatus of the type indicated having a section or mold body and a ring or cap provided in their contact faces with complemental registering channels combining to form a handle mold in communication with the interior of the receptacle mold, and means for upwardly deflecting the molded handle after the completion of the molding operation and consisting of a lifter block movable with relation to and carried by one of the mold sections.

Apparatus for Feeding Molten Glass. U. S. 1,473,587. Nov. 6, 1923. Karl E. Peiler of West Hartford, Conn., assignor to Hartford-Fairmont Company, of Canajoharie, N. Y.

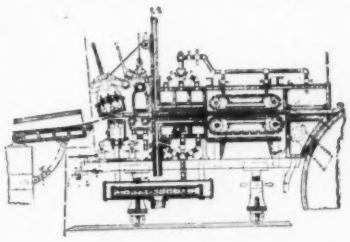
The invention described herein relates to means to be employed for changing the direction of movement of the gobs, gathers, or mold charges of glass as they pass from their point of formation and direct the gobs or gathers centrally into the molds.



The inventor claims in apparatus for delivering gathers of molten glass, the combination with a shaping mold, of a deflector in the form of an inverted trough positioned to receive the gather tangentially and of such longitudinal curvature that the gather is gradually deflected from its original path and follows the curved trough without deformation into the mold.

Method and Apparatus for Forming Glass. U. S. 1,474,019. Nov. 13, 1923. Robert M. Corl, of Maumee, O., assignor by mesne assignment to the Erie Glass Co., of Toledo, O.

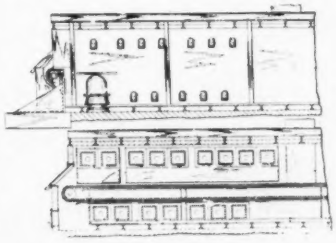
It is found that glass, when drawn or flowed directly from a pot to a thickness usual for commercial ware, will solidify or set too quickly on exposure to atmospheric temperature. This cooling is a source of great annoyance and trouble.



By this invention there is produced an easily made thick sheet, which may be designated the sheet mass, and after allowing such mass to cool sufficiently for easy handling, the thickness is reduced by the application of a localized high heat to a portion of the sheet mass. This enables the temperature of the sheet mass at the point of formation of the finished or commercial sheet to be readily controlled and the correction of defects in the sheet mass effected. The inventor claims that by this reduction of thickness of the sheet mass most of the surface defects which may exist therein disappear.

Lehr. U. S. 1,473,897. Nov. 13, 1923. George W. Batchell, of Wellsburg, W. Va.

The invention particularly has for its object to produce a low temperature flame progressively in vicinity of the articles to be annealed as they are carried through the lehr. The inventor claims a lehr, a plurality of flues extending across the top and bottom of the lehr and divided into sets, the sets interconnected to form a pair of continuous passageways for the gas through the lehr, one at the top and the other at the bottom of the lehr, the number of flues in each set increasing towards the stock end of the lehr, boxes for connecting the sets of flues and forming the side walls of the lehr, a burner located at one end of each of the passageways, air inlets located at the ends of the flues to permit the air to enter into the flues in the direction that the flame from the burner is moving to maintain the flame and the combustion of the gas as it progresses through the passageways.



The Glass World and What It Is Doing

News of the Industry

The Age of Canning

The close relationship existing between the manufacturers of glass containers and the canning industry is an assurance that keen interest will be shown by the trade in a 32-page brochure, "The Age of Canning and the Canning Age," recently brought out by the Miller Freeman Publications, publishers of *Canning Age*, 27 Pearl street, New York. This attractive publication is full of information and statistics on the canning industry. It demonstrates by facts and figures the magnitude of the industry. It shows that the domestic consumption of canned foods hovers close to the billion dollar mark. Exports are five times their pre-war figures. Over 200 different products are now packed in glass and tin containers in 6,500 establishments.

Details of the total annual pack and its value are given by states on vegetables, fruit, canned fish and oysters, condensed and evaporated milk, and meats. The total number of cases packed being 166,086,234 with a total value of $837,926,749.

Information is given concerning the size and character of packing plants and outline maps show their locations and production, those packing in glass being differentiated from the others.

Separate figures are given for each state showing the value of products packed in glass, the total for all states amounting to $155,960,971.

Figures obtained from Government reports combined with information collected from reliable sources by the publishers, showing the number of plants using glass and tin containers, and believed to be the most reliable compilation so far published, show that of 4,280 canneries there are 574 packing in glass. A partial list of products packed in glass is given, as follows:

PRODUCTS PACKED IN GLASS

Ales—(Non-Alcoholic)
Ammonia
Artichokes
Beef Stew

Beers
Bitters
Bluing
Boned Chicken
Boned Squab

Cake Icing
Calf's Tongue
Candies
Capers
Caston Stem Ginger Buds
Cheese
Chicken Breasts
Chicken—Cream, Potted
Chocolate
Cider
Cocoa
Coffees
Corned Beef
Crete de Coq
Curry Powder

Disinfectants
Drugs

Estragon
Extract of Meat—Solid, Liquid, Bouillon, Meat Juice
Extracts

Fermillac
Financiers
Fish
Floor Polish—Floorine
Fruit
Fruit Nut Compote
Fruit Salad—Fresh and in Brandy
Furniture Polish

Garlic

Honey

Infants' Food
Inks

Jams and Jellies and Compotes
Javelle Water

Kumyss

Lamb's Tongue
Lubricating Oil

Marmalade
Marrons
Melba Sauce
Metal Polish
Mince Meat
Mineral Waters
Miscellaneous Waters and Soft Drinks
Mustard

Nut Meats

Olive Oil
Olives
Oxford Brawn
Ox Tongue

Peanut Butter
Peanut Oil
Pickles
Polishes
Preserved Ginger
Preserves
Prunes—(French)
Puncheezy in Brandy

Salad Dressing
Sauces
Sausages—Frankfurters
Shoe Polish
Silver Polish
Sliced Bacon
Smoked Beef
Spices
Syrups

Tamarinds—Preserved

Vegetables
Vinegar

Zoolack

A useful chart showing the duration of packing seasons in the different states is another feature of "The Age of Canning and the Canning Age."

Court Hears Glass Manufacturers' Appeal

The appeal made to the United States Supreme Court by the National Association of Window Glass Manufacturers, the National Window Glass Workers, and others to set aside the decision made last April by the Federal District Court for Northern Ohio, holding them guilty of having, in violation of the Sherman anti-trust law, entered into an agreement which had the effect of restraining interstate commerce, came before the Supreme Court at Washington on November 23.

Solicitor-General Beck urged the Court to hold invalid and in violation of the Sherman anti-trust law the agreement between the employers and employees in the hand-blown window glass industry. Otherwise, Mr. Beck contended, all industry which desires to enhance prices will be able to do so by entering into such agreements, which he denounced as a restriction of production in violation of the Federal laws.

John W. Davis, formerly Solicitor-General of the United States and Ambassador to Great Britain, appearing for the appellants, contended that the agreement between manufacturers and workers for a wage scale based on a two-period year was a well-established practice, justified by conditions in the industry, that the Government had offered no proof that it was in restraint of trade, that the agreement did not relate to interstate commerce, but even if it had done so, no unreasonable restraint was involved.

The decision of the Court has not yet been announced. It is said that this is the only anti-trust case of magnitude now pending in the Supreme Court.

American Ceramic Society Nominations

The officers placed in nomination for 1924 by the nominating committee of the American Ceramic Society and the nominations of division representatives on the board of trustees are as follows: President, Robert D. Landrum, Cleveland, O.; vice-president, Raymond M. Howe, Pittsburgh, Pa.; treasurer, H. B. Henderson, Columbus, O. Trustees: Art Division (1-year), F. H. Rhead, Zanesville, O.; Enamel (1-year), R. R. Danielson, Washington, D. C.; Refractories (1 year), J. S. McDowell, Pittsburgh, Pa.; Glass (2 years), J. C. Hostetter, Corning, N. Y.; White Wares (2 years), C. C. Treischel, Pittsfield, Mass.; Heavy Clay (3 years), C. Forrest Tefft, Watsontown, Pa., and Terra Cotta (3 years), R. L. Clare, Woodbridge, N. J.

The 1924 annual convention of the American Ceramic Society will be held at the Hotel Traymore, Atlantic City, N. J., February 4 to 9, inclusive. The Glass Division will hold two sessions on both Tuesday and Wednesday of that week, for the reading and discussing of papers.

Prepare for 1923 Glass Census

The Bureau of the Census will take a census of manufacturers covering the calendar year 1923. This work is being done in compliance with the Act of Congress approved March 3, 1919, and the schedules have been prepared after conference with associations and others interested in the various industries.

These schedules will be mailed during the first week of January, and the members of National Bottle Manufacturers' Association and all others engaged in the glass industry are urged to make the reports promptly, as the Bureau has agreed to tabulate the data as rapidly as the schedules are received and to publish the tables within a few days after the receipt of the last report.

The Bureau has been cooperating very closely with the industry and desires to be of service to it. It is important that the reports be made promptly by mail, otherwise the government will be put to the expense of sending a special agent to the various establishments.

Sending Catalogs Abroad—A Warning

The Department of Commerce has issued frequent warnings in the past regarding the importance of sending catalogs and other advertising matter to foreign countries in the proper way to avoid causing annoyance and expense to the recipient. But careless practices persist and in an endeavor to bring the facts before manufacturers and exporters who wish to obtain orders from abroad and to acquaint them with the proper methods to follow, the Department recently issued Trade Information Bulletin, No. 145, on "Shipment of Samples and Advertising Matter to Europe." This bulletin gives the conditions of shipment to twenty-five different countries. Trade Information Bulletin, No. 122, issued last July, is devoted exclusively to the various countries of the British Empire. Copies of these publications may be obtained from the Foreign Tariffs Division of the Bureau of Commerce, Washington, D. C.

Many countries impose import taxes on advertising matter. Some kinds of matter are unmailable. Numerous restrictions exist and these restrictions differ in practically all countries. Samples and advertising matter sent to foreign firms are intended to serve as "trade getters." However, unless properly handled their distribution may act as a boomerang and retard rather than promote sales. In order to secure the full benefit of the expenditure represented by catalogs and samples, they should be sent by such channels as will insure their delivery to the desired foreign customers free of all charges and with the minimum annoying procedure generally attending the clearance of parcels through the customs.

Preparing a Dictionary of Specifications

The Department of Commerce has undertaken the preparation of a dictionary or handbook of specifications for supplies purchased by federal, state and municipal governments and public institutions, with the object in view of bringing about the widespread use of specifications by these agencies as a basis of purchase for supplies. The Department is now preparing a classified list of some 5,000 specifications of interest to public purchasing officials, which it is proposed to send to the interested organizations and individuals for comment so that it may be made as complete as possible before publication. A list has also been prepared of 20,000 items of interest to federal, state and municipal governments and public institutions for which there should be specifications. Approximately 75 per cent of the supplies purchased are not at present covered by specifications.

Co-operative Dairymen Successful

The Dairymen's League Co-operative Association, organized to market milk producers' products and which has a large distributing organization in New York City, is reported to have marketed milk worth over $82,000,000 in one year. A recent report from Cincinnati, O., states that a similar organization of milk producers in that territory has purchased one of the largest milk distributing plants in Cincinnati and will hereafter market its members' products. It is understood that a number of similar co-operative milk distributing organizations are in successful operation in various parts of the country. It will be interesting to learn whether these changes in milk marketing methods will have a perceptible effect on the manufacturers of milk bottles.

Largest Tumbler Grinding Machine

The Miller Machine & Mold Works, manufacturers of glass house machinery, 705-719 Ann street, Columbus, O., recently put on the market what is said to be the largest automatic tumbler grinding machine in the world. This machine requires a floor space of 5½ ft. wide by 7 ft. long, is 9 ft. in height, and weighs approximately 7,000 pounds.

It is a vertical machine of similar design to the Miller 12 spindle machine with the exception that it is built on a larger radius and has 18 spindles instead of twelve. The machine has a minimum grinding speed of 30 per minute, a medium speed of 35 and a maximum speed of 40 per minute. One of the features claimed is that the tumblers are on the stones longer, which gives a perfect grind.

It is recommended to be motor driven only, due to the continuous operation grinders of this character are usually put to. It requires a 15 h.p. motor. Two of these grinders are now in operation at the Hocking Glass Company, Lancaster, O.

Paint and Glass Companies Merge

After several months negotiations the Condie-Bray Glass & Paint Co., of St. Louis, and the Waggener Paint & Glass Co., of Kansas City, have merged their interests, and the consolidated company will hereafter operate as the Condie-Bray Glass & Paint Co. of Missouri, under the name of Condie-Bray Glass & Paint Co. in St. Louis and Waggener Paint & Glass Co. division in Kansas City. Each of the two companies has full paid up capital of $500,000 giving the new company a capitalization of $1,000,000. The companies have well equipped and modern paint factories at both St. Louis and Kansas City, and will carry full stocks of plate and window glass, skylight glass, and manufacture leaded glass and mirrors. The officers of the company are: H. D. Condie, president; J. W. Bray, vice-president and treasurer; C. W. Condie, vice-president and secretary; E. V. Hanser, assistant secretary; S. C. Frampton, assistant treasurer. C. W. Condie will have personal direction of the Kansas City division.

Recuperators for Revolving Pots

It is announced by the Chapman-Stein Furnace Company, Mt. Vernon, O., that two additional Chapman-Stein refractory tile recuperators have been ordered by the Owens Bottle Company for use in connection with the No. 3 and No. 5 revolving pots on the No. 3 tank at their Clarksburg, W. Va., factory. This order, when completed will give the Owens company eight revolving pots equipped with Chapman-Stein recuperators, seven of which have been installed this year. The last two will be added to the 13-foot pots and will be used in connection with the larger improved Owens bottle machines.

The Chapman-Stein Company states that this type of recuperator is especially adapted to the heating conditions required for revolving pots. To indicate the extent to which the type has been standardized for revolving pots it is stated that the order for the two additional recuperators referred to above was telephoned on a certain day from Toledo to Mt. Vernon, O., and complete shipment of the special patented tile and all necessary material was made the following day.

Belgian Glass Situation Favorable

The plate glass market is unchanged and favorable, according to *Commerce Reports*, with producers engaged in increasing their manufacturing capacity. After a temporary slackening in demand for special glass, business is now improved and prices are advancing. The window-glass situation is unusually favorable for the season, and current production is fully absorbed while some plants are engaged until January. The best current markets are France, Netherlands, China, Japan, and Scandinavia.

The Voice of Labor on Prohibition

The report of the Executive Council to the convention of the American Federation of Labor at Portland, Ore., in October, 1923, giving the Council's conclusions after an investigation into the effects of the Volstead Act, contained a denunciation of the Act and declared in favor of its modification. Branch No. 3 of the Glass Bottle Blowers' Association of the United States and Canada has endorsed the declaration.

Pittsburgh Plate Wins Damages

Awards were announced in November in a number of claims before the Mixed Claims Commission at Washington for damages from Germany for losses resulting from the World War. Among the claims allowed was one for $990,000 in favor of the Pittsburgh Plate Glass Company. Part of the loss covered materials requisitioned by the Germans and part was due to destruction of the company's property in Belgium.

New Publications

The Brown Instrument Company, Philadelphia, Pa., Catalog No. 86, 40 pages explaining completely Brown automatic temperature control pyrometers, Brown time-temperature cycle control, and Brown automatic control thermometers. Illustrated with actual photographs and diagrams showing installations on many types of furnaces. Applicable to lehrs, pot furnaces, revolving pot furnaces, tanks and pot arches.

The Bureau of Foreign and Domestic Commerce has announced that current business statistics gathered for the *Survey of Current Business* will hereafter be distributed in the form of advance leaflets each month to those subscribers of the Survey who request them. One set of leaflets will be issued about the twentieth of the month and another set will be mailed at the end of the month giving figures received after the twentieth of the month. Subscribers who desire these advance leaflets should send their requests to the Bureau of Census, Department of Commerce, Washington, D. C.

The Japan Business Directory for 1923. By S. H. Sommerton, 1085 pages. Price, $7.50. A limited number of copies of the directory are available through the World Wide News Association, 303 Fifth avenue, New York, the American representatives.

Eastern Commerce, a monthly trade journal of the Far East, has just compiled this business directory of Japan, the first of its kind ever published in that country. The table of contents comprises lists of Japanese banks and business firms, their addresses and lines of business in detail; names of proprietors and exporters classified by the products they handle; data on Manchuria, Korea, Formosa and Hokkaido; postal information, cables and local telegraph service, weights and measures.

Coming Meetings

The Pittsburgh, Pa., Exhibition of Glass and Pottery will be held January 7 to 28, 1924.

The next annual meeting of the American Ceramic Society will be held at Atlantic City, N. J., February 4 to 9, 1924.

The next meeting of the Mirror Manufacturers' Association will be held at the William Penn Hotel, Pittsburgh, Pa., December 4 and 5.

The National Glass Distributors' Association will hold their annual meeting on December 4 and 5 at the William Penn Hotel, Pittsburgh, Pa.

The National Exposition of Power and Mechanical Engineering will be held at Grand Central Palace, New York, December 3 to 8, 1923.

The next annual meeting of the National Ornamental Glass Manufacturers' Association of the United States and Canada will be held at New York, June 24 to 26, 1924.

Society of Glass Technology, S. English, secretary, announces meetings for 1923-24 as follows: 1923: December 12, London; 1924: January 16, Manchester; February 20, Sheffield; March 19, Stourbridge; April 16, Sheffield (annual general meeting); May 21, London and June 18, Sheffield. Details of programs will be announced a week prior to each meeting.

Verified News of Trade Activities

The American Window Glass Company has moved its New York office from 220 Fifth avenue to the Metropolitan Tower, Madison Square, New York, Room 192.

Bay Ridge Glass Works, Inc., has been incorporated with a capital stock of $10,000, by A. Paul Loshen, 481 Fulton street, Jamaica, N. Y., Hyman Loshen and Mima Blackburn, also of Jamaica.

Ball Brothers Company, Muncie, Ind., has placed a contract with R. D. Wood & Company, Philadelphia, Pa., for a third installation of three of their latest type heavy duty automatic gas producers.

The Tampa Glass & Bottle Manufacturing Company, Ybor City Branch, Tampa, Fla., manufacturers of a line of milk bottles and flint prescription ware, is installing a new Amsler-Morton lehr of latest design.

Hand-blown window glass manufacturers, at a meeting held at Wheeling, W. Va., on November 22, again decided not to reopen their plants until a mutually satisfactory wage agreement is reached with the workers.

Columbia Glass Company, Los Angeles, Cal., has been incorporated with a capital of $250,000 to manufacture glass products. The incorporators are: George W. Elmers and Walter E. Smith, both of Los Angeles.

The Glass Container Association of America announces the removal of its business offices from 70 Fifth avenue to 22 East 75th street, New York City, and the re-establishment of its research laboratories at the same address.

The Maryland Glass Corporation, manufacturers of bottles, Baltimore, Md., is erecting two one-story brick buildings, one 120 by 100 ft. and the other 60 by 140 ft., at an estimated cost of $50,000. The buildings will be used as warehouses.

The Hartford-Empire Company recently installed three single unit feeders at the plant of the **Chattanooga Bottle & Glass Manufacturing Company,** Chattanooga, Tenn., two of which have been started and are at present in successful operation.

According to press reports the Post Office Department at Washington, D. C., has issued an order changing the name of James City, Pa., the home of the **American Plate Glass Company's** large factory which was recently purchased by the Durant Motors Corporation, to Durant City.

The Buckeye Glass & Mirror Company, 42 Eleventh street, Toledo, O., bevelers of plate glass, mirror manufacturers, and dealers in cut glass for show cases and automobile visors, etc., has installed a new heating system and other equipment which will double the capacity of its mirror silvering department.

Reports from Detroit state that one of the three furnaces in the new process plate glass factory of the **Ford Motor Company** at River Rouge has been put into operation and that fires have been lighted under the second furnace, while the third, it is expected, will be put into operation early next year.

The Canadian Glass Company, Ltd., Amherstburg, Ontario, Canada, is reported in press despatches to have applied for incorporation with a capital of $1,500,000. The incorporators are reported to be: A. A. Ichenhour, Amherstburg; F. G. Hoblitzell, Sarnia; D. R. Grossman, A. E. Thompson and N. A. McLaity, Windsor, and A. Eastman, Kingsville.

The building of the **Loubat Glassware & Cork Company, Ltd.,** at 510-516 Bienville street, New Orleans, La., was practically destroyed by fire on October 22. The company reports that the loss has not yet been determined but it is estimated at more than $150,000. A new building will be erected on the site as soon as all adjustments have been made.

According to an Associated Press dispatch, losses in machinery and equipment estimated at $250,000 were caused when fire on November 25 destroyed one of the three factory buildings of the **Illinois Glass Company's** plant at Bridgeton, N. J. The building was used for the manufacture of bottles and fine tubes. The report states that about 500 employees were temporarily thrown out of employment.

The Ohio Hydrate & Supply Company, Woodville, O., announce that they are going to manufacture a pure white plastic hydrate and ground burnt lime for use in glass manufacturing and expect to produce between 50 and 100 tons of ground burnt lime per day for that purpose. F. Witmer, general sales manager, states that the product is 99½ per cent pure and of unusual fineness and that the ignition loss is lower than that of most burnt limes used in glass making.

The Pittsburgh Sheet Glass Company has bought the plant of the Pittsburgh Window Glass Company at Washington, Pa., and after extensive alterations and enlargements will start production next Spring with an improved type of machine which has been developed by the company. Walter A. Jones, of Columbus, O., is the leading spirit in the new enterprise. Associated with him are Jo L. Keener, of Morgantown, W. Va., N. R. Baker of the Citizen National Bank, and Edward C. Stewart, both of Washington, Pa.

An amusing souvenir has been brought out by the **Belmont Tumbler Company,** Bellaire, O., in the form of a small tumbler graduated to measure the proper quantity the user should imbibe of the prohibited but popular beverage the glass is designed to contain. The mark for ladies is set about one "finger" from the bottom of the glass; for gentlemen, about two "fingers," while the stopping place for those of porcine characteristics is clearly indicated near the very top of the glass by the suggestive figure, etched on the glass, of a hog with his mouth wide open.

A pot of glass in one of the furnaces of the **Union Glass Company,** Somerville, Mass., went down suddenly about midnight on October 28, letting the contents, about 2,500 pounds of metal, down through the eye into the cave with extreme speed. This resulted in a hot air explosion at considerable distance from the eye, causing an extensive fire in the caves, which are large, and resulting in the loss of some 3,000 sq. ft. of flooring around the central furnace. The fire in no wise affected any of the furnaces or their foundations nor any of the buildings, excepting the floor loss.

Charles Piez, president of the **Link-Belt Company,** Chicago, Ill., has announced the purchase of the **Meese & Gottfried Company,** of San Francisco, Los Angeles, Seattle and Portland. Meese & Gottfried Company, and its predecessors, have been manufacturers of power transmission machinery and distributors of conveying and transmission machinery on the Coast for more than forty years. It is the intention of the new owners, to add to the facilities and enlarge present stocks, so that more prompt service to its customers will be insured. The Link-Belt organization now includes two manufacturing plants at Chicago, three at Philadelphia, three at Indianapolis and one each at San Francisco, Seattle and Toronto.

Personal Items

H. S. Conklin, formerly assistant superintendent of the No. 2 plant of the American Window Glass Co., Jeannette, Pa., is now connected with the Libbey-Owens Sheet Glass Company and will be located temporarily at Charleston, W. Va.

E. Y. Davidson, Jr., illuminating engineer, Macbeth-Evans Glass Company, Pittsburgh, Pa., delivered an address entitled, "Brief History of Illuminating Glassware—Tests of Enclosing Globes and Their Use" at a meeting of the Illuminating Engineering Society, Philadelphia, Pa., held on November 26.

Frederick Carder, connected with the Steuben factory of the Corning Glass Works, Corning, N. Y., and an authority on colored and art glass, will address members of the Pittsburgh District Section of the American Ceramic Society at a meeting to be held Tuesday, December 4, 1923 in Fellows Room, Mellon Institute, Pittsburgh, Pa.

Alexander Silverman, head of the Department of Chemistry, University of Pittsburgh, Pittsburgh, Pa., delivered an address on "Education in Pure Science a Benefit to American Industry" at the joint session of the Milwaukee Association of Commerce, the Division of Industrial and Engineering Chemistry of the American Chemical Society and the Section on Chemical Education in convention at Milwaukee, Wis., September 10 to 14, 1923. Among numerous industrial developments resulting from research and discoveries in pure science, Professor Silverman cited glass as one of the important industries.

Burton A. Ford has been appointed secretary and general manager of the National Lime Association. For the past three months Mr. Ford has been acting secretary of the Association, having been appointed to this position at the annual convention held last June. He is a graduate of the University of Maryland, and until the Summer of 1922 was with the Virginia-Carolina Chemical Company in the capacity of division manager, and was also secretary-treasurer of the Bryant Fertilizer Company. In the Summer of 1922 he became assistant to W. R. Phillips, who was then general manager of the National Lime Association, so he is thereby well qualified to handle his present position.

Recent Deaths

W. S. Brady

As this issue goes to press it is reported that W. S. Brady of Wheeling, W. Va., former president of the Hazel-Atlas Glass Company, died in New York City on Saturday, November 24, at the age of seventy.

Orien A. Hanford

Orien A. Hanford, formerly widely known throughout the industry as an engineer and inventor of automatic bulb machinery, died in Columbus, O., on October 15, at the age of sixty-two.

Inquiries Received

For further information address THE GLASS INDUSTRY

160. We are interested in obtaining the names and addresses of those firms which manufacture non-shatterable glass. (Nov. 9).

161. Will you kindly give us the addresses of consulting engineers experienced in glass factory planning, from whom we may obtain plans and estimates on equipment to handle raw material in a foreign glass and bottle factory of comparatively large production, and for the re-planning of present equipment so as to make use of the so-called automatic system. (Oct. 29.)

162. Please send names of all manufacturers of Tiffany glass. (Nov. 8.)

163. Some concerns which we cannot reach owing to the fact that they do not advertise in your paper, might be interested to know that we are modernizing an existing glasshouse in Brazil, and also preparing plans for an entirely new one where window glass will be produced, as well as all sorts of narrow and wide mouth articles. We would like catalogs *in duplicate* from all makers of furnaces and machinery. (Oct. 31.)

164. Where can we obtain information regarding metal gauges in standard sizes for gauging bottle necks? (Oct. 29.)

165. We desire the names of European glass manufacturers and exporters to the United States of window and plate glass. (Nov. 5.)

Stock Quotations

(Reported by Moore, Leonard & Lynch, Frick Building, Pittsburgh, Pa.)

PITTSBURGH STOCK EXCHANGE, NOV. 23, 1923.

	Bid	Ask	Last
American Window Glass Machine Com....	91	92	92
American Window Glass Machine Pfd.....	94	94½	94
American Window Glass Preferred.....	108½	..	108½
Pittsburgh Plate Glass.....	207	208	207
U. S. Glass	..	24	25

During the past month the glass issues have held steady and several have been quite active. All the companies are reported to be showing satisfactory earning ability with the outlook for the coming months very good. There have been many rumors in circulation regarding favorable developments for the stockholders of Pittsburgh Plate Glass.

WHEELING STOCK EXCHANGE, NOV. 23, 1923.

	Bid	Ask	Last
Hazel-Atlas	35	36	36
Imperial Glass	90	93	95
Fostoria Glass	140	..	140
Central Glass	95	100	100

A quiet and inactive market has prevailed for the last month. Throughout the entire group of local stocks, there was a weakening in the price level and although the glass issues held firm they were inactive and a slight weakness was noticeable in Imperial.

TOLEDO STOCK EXCHANGE, NOV. 23, 1923.

	Bid	Ask	Last
Owens Bottle Machine, common.....	43⅝	44	43⅝
Libbey-Owens Sheet Glass, common.....	137	142	..
Libbey-Owens Sheet Glass, preferred.....	103	108	..

Current Prices of Glass-Making Materials

Quotations furnished by various producers, manufacturers and dealers

November 23, 1923

	Carlots	Less Carlots
Aluminum hydrate ($Al(OH)_3$)...lb.	.05	.05½
Aluminum oxide (Al_2O_3).....lb.	.06½	.07
Antimony oxide (Sb_2O_3).....lb.	.08	.09
Arsenic trioxide (As_2O_3) (dense white), 99%.....lb.	.14	.14½
Barium carbonate ($BaCO_3$) (precipitated).....ton	70.00	85.00
Barium hydrate ($Ba(OH)_2$).....lb.	.05	.05½
Bone ash.....lb.	.05½	.06½
Borax ($Na_2B_4O_7 10H_2O$).....lb.	.05½	.06
Borax, fused ($Na_2B_4O_7$) any mesh.lb.	.19	.20
Boric acid (B_2O_3), fused.....lb.	.35	.35
Cadmium Sulphide (CdS)—		
Red.....lb.	..	1.65
Orange.....lb.	..	1.55
Yellow.....lb.	..	1.65
Chrome Oxide (Cr_2O_3).....lb.	.36	.37
Cobalt Oxide (Co_2O_3)—		
In bbls.....lb.	..	2.10
In 10 lb. tins.....lb.	..	2.20
Copper oxide—		
Red (Cu_2O).....lb.	..	.15–16
Black (CuO).....lb.	..	.26
Black prepared.....lb.	..	.30
Cryolite (Na_3AlF_6).....lb.	..	.09½
Feldspar—		
100 mesh.....ton	11.00	24.00
80 mesh.....ton	..	24.00
40 mesh.....ton	..	..
Ferrous oxide (FeO).....lb.	..	..
Fluorspar (CaF_2)—		
Powdered white, 95%.....ton	40.00	50.00
Powdered white, 90%.....ton	38.00	45.00
Hydrofluoric acid (HF) 60% (in lead carboys).....lb.	..	.13
Kaolin (f.o.b. mine).....ton	9.00	..
Lead Oxide (Pb_3O_4) (red lead)...lb.	.11	.11¼
Litharge (PbO).....lb.	.10½	.10¼
Lime—		
Hydrated ($Ca(OH)_2$) (in 50 lb. paper sacks).....ton	12.50	..
Burnt (CaO) ground, in bulk.ton	9.00	..
Burnt, ground, in paper sacks.ton	11.00	..
Burnt, ground, in 280 lb. bbls. per bbl......	2.15	2.30
Magnesium carbonate ($MgCO_3$)...lb.	..	.09
Manganese 85% (MnO_2).....lb.	.03½	.03¾
Nickel oxide (Ni_2O_3), black, for nickel content.....lb.	.32	.45
Nickel monoxide (NiO), green, for nickel content.....lb.	.30	.50
Potassium carbonate—		
Calcined (K_2CO_3) 90%.....lb.	.06¼	.06¾
Hydrated (KOH) 90%.....lb.	.06¾	.07¼
Potassium nitrate (KNO_3) (gran.).lb.	.06½	.06¾
Potassium Permanganate ($KMnO_4$).....lb.	..	.17
Powdered blue.....lb.	..	.26
Standard formula.....lb.	..	.38
Salt cake, glassmakers (Na_2SO_4), f.o.b. works.....ton	25.00	35.00–40.00
Selenium (Se).....lb.	..	2.10–2.85
Soda ash (Na_2CO_3) dense, 58%— f. o. b. works.		
Bulk.....Flat 100 lb.	1.40	..
Bulk, on contract....Flat 100 lb.	1.35	..
In 400 lb. bbls., on contract.100 lb.	1.69	1.79
In 300 lb. bags, on contract.100 lb.	1.45	1.55
Spot orders .05 per 100 lbs. higher.	..	..
Sodium nitrate ($NaNO_3$), refined..lb.	.04¼	.04½
Sodium selenite (Na_2SeO_3).....lb.	1.90	2.00–2.50
Sodium Fluosilicate (Na_2SiF_6)....lb.	.07¼	.08
Sulphur (S)—		
Flowers, in bbls. .....Per 100 lb.	3.25	3.55–3.80
Flowers, in bags.....Per 100 lb.	3.00	3.30–3.55
Flour, heavy, in bbls..Per 100 lb.	2.50	2.80–3.05
Uranium oxide (UO_3), 100 lb lots.lb.	..	2.25
Zinc oxide (ZnO).....lb.	.08¼	.08½

Monthly Summary of United States Foreign Commerce in Glass

Exports

Corrected to October 23, 1923	September 1922 Quantity	September 1922 Value	September 1923 Quantity	September 1923 Value	Nine Months Ending September 1922 Quantity	Nine Months Ending September 1922 Value	Nine Months Ending September 1923 Quantity	Nine Months Ending September 1923 Value
Glass and glass products (total).....	.....	$681,229	.....	$890,477	.....	$6,296,265	.....	$8,279,661
Plate and window glass—								
Window glass, common, box 50 sq. ft.....	3,528	20,109	2,574	12,661	25,570	136,235	34,403	186,233
Plate glass, unsilvered, sq. ft.....	70,202	32,973	166,748	78,488	2,192,878	913,499	1,691,139	713,467
Other window and plate glass, n. e. s.....lbs.	204,282	22,093	196,174	27,783	1,421,928	161,776	2,756,318	314,498
Glass containers (bottles, vials and jars).....lbs.	3,298,811	206,728	6,167,709	269,880	30,207,595	1,669,631	56,573,393	2,687,220
Table glassware, plain.....lbs.	1,455,745	138,547	1,710,717	195,806	8,797,625	967,020	15,205,327	1,681,308
Table and other glassware, cut or engraved....lbs.	45,283	16,353	78,794	22,528	312,460	118,133	433,063	160,856
Glassware for lighting—								
Lamp chimneys and lantern globes.....lbs.	151,512	27,240	181,679	28,995	1,054,667	218,527	1,490,694	290,918
Globes and shades for lighting fixtures.....lbs.	156,699	37,495	99,151	34,630	1,106,614	314,097	1,087,203	335,051
Lamps and other illuminating devices, chiefly of glass.....lbs.	98,292	27,853	99,604	31,227	826,324	292,732	1,159,242	297,653
Chemical glassware.....lbs.	21,895	13,103	20,834	14,524	221,846	117,775	170,158	123,644
Electrical glassware, except for lighting.....lbs.	289,250	18,278	344,546	16,629	1,610,893	124,059	2,205,893	140,877
Other glassware, n. e. s.....lbs.	664,450	120,457	914,797	157,326	10,083,245	1,262,781	7,754,241	1,347,936

Imports

Corrected to October 23, 1923	September 1922 Quantity	September 1922 Value	September 1923 Quantity	September 1923 Value	Nine Months Ending September 1922 Quantity	Nine Months Ending September 1922 Value	Nine Months Ending September 1923 Quantity	Nine Months Ending September 1923 Value
Glass (total).....	.....	$1,251,945	.....	$2,194,358	.....	$9,255,169	.....	$18,192,364
Cylinder, crown, and sheet, lbs.....dut.	3,285,750	152,771	.....	.....	41,597,241	2,085,182	.....	.....
Unpolished, lbs.....dut.	.....	.....	3,339,300	137,301	.....	.....	38,782,633	1,683,705
Bent, ground, beveled, colored, painted, etc., and polished.....dut.	.....	.....	.....	47,882	.....	.....	.....	607,753
Plate glass—								
Unsilvered, sq. ft.....dut.	970,813	458,970	2,326,604	1,528,240	6,220,241	2,819,731	19,595,346	11,637,463
Fluted, rolled, etc., or silvered, or containing wire netting, sq. ft.....dut.	.....	.....	202,628	26,081	.....	.....	1,896,142	291,558
Containers—bottles, vials, etc.....dut.	.....	31,091	.....	10,558	.....	220,884	.....	169,106
Table and kitchen utensils, lbs.....dut.	.....	.....	.....	13,151	.....	.....	.....	97,989
Glassware, cut or decorated, lbs.....dut.	.....	288,534	405,026	139,943	.....	1,673,190	2,767,402	1,018,617
Blown glassware, n. e. s., lbs.....dut.	.....	.....	500,239	130,421	.....	.....	4,473,199	950,542
Other glassware.....} free	.....	21,011	.....	.....	.....	106,800	.....	.....
} dut.	.....	299,568	.....	160,781	.....	2,349,382	.....	1,735,631

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SINCE our inception almost 50 years ago we have always adhered to a fixed policy of manufacturing strictly quality glass making equipment.

During that period it has been our pleasure to serve many of the leading glass manufacturers in the industry and our experience has conclusively proven that the installation of good equipment is the first essential in the successful production of glassware.

If you want to eliminate costly shutdowns and constant repair bills—if you want your workmen to turn out a perfect product at all times without interruption, if you want to produce the finest ware in the most economical way—you must install high grade glass making equipment.

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GLASS WORKING MACHINERY DEVELOPED FOR SPECIAL PURPOSES

CONSULTING ENGINEERS FOR MANUFACTURERS OF GLASSWARE

LEHRS AMCO

Amco Type Continuous Muffle Lehrs

AMCO LEHRS are of the long firebox type. They cost more than the ordinary short firebox Lehrs because of the additional material required and the superior quality of the Amco chain.

The extra cost is justified by the better annealing and greater capacity with uninterrupted service and the lowest fuel consumption of any Lehr.

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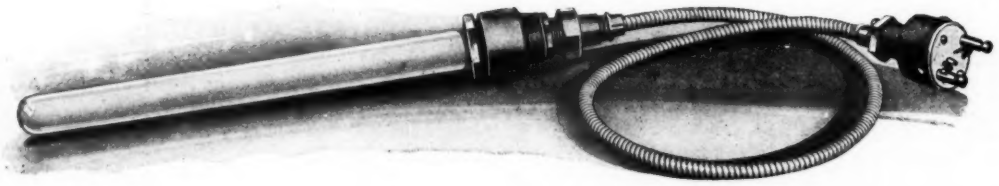

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The hardest worked part of a glass house pyrometer is the thermocouple.

If you were to make a study of thermocouple service in glass plants you would find Engelhard thermocouples giving long accurate service in a majority of the plants where temperatures are high and conditions severe.

This is no accident. It is the result of good materials, proper design and good workmanship.

Our engineers will gladly discuss an *economical* pyrometer installation with you.

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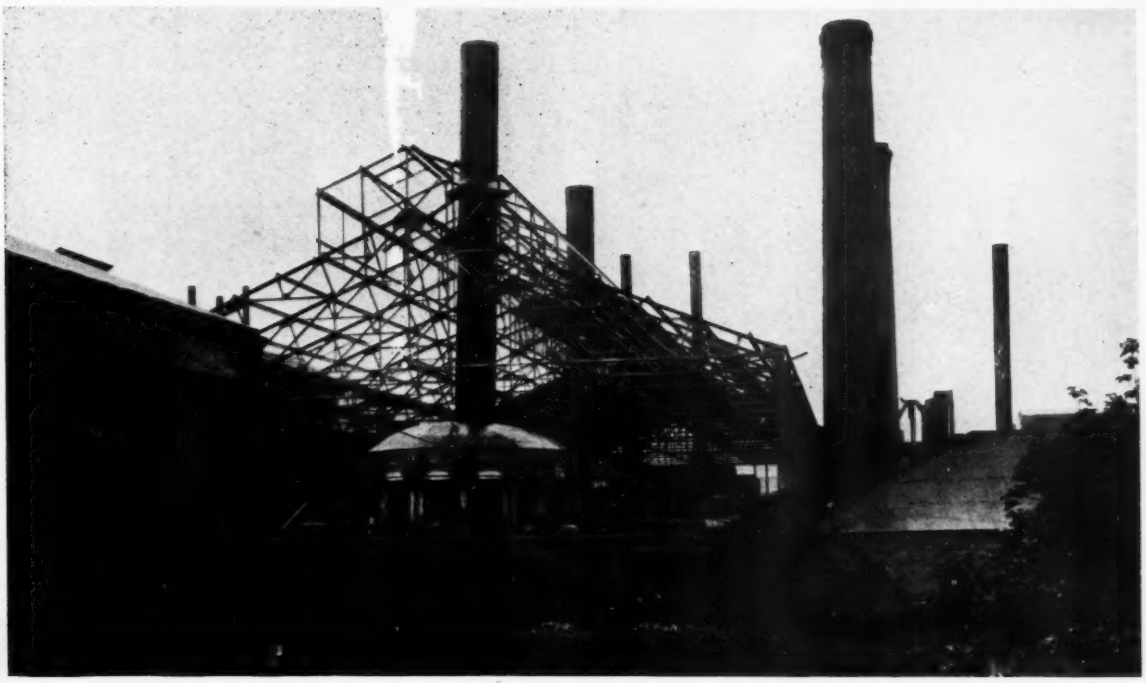

Repeat Contracts Mean Complete Satisfaction

AUSTIN has designed and built several plant units for the H. C. Fry Glass Company, Rochester, Pa. The illustration shows the most recent building, under construction. The Maryland Glass Corporation, too, has awarded Austin a repeat contract for buildings of Austin design, which are now under construction by Austin. These repeat contracts give undeniable evidence of the complete confidence glass manufacturers have in the effectiveness of Austin Unit Responsibility.

Austin Unit Responsibility makes one organization responsible for the entire building project—layout, design, construction and equipment. All the work is executed by men who are directly connected with that organization and whose activities are confined to industrial building only. The final cost of the building project is guaranteed, the date of delivery is guaranteed and the quality and workmanship of the completed structures are guaranteed.

Whether you are in need of a complete plant or a single plant unit the services of Austin Engineers are at your disposal. Austin will serve you as efficiently and promptly as they have served many prominent glass manufacturers in the United States and foreign countries. Phone, wire or send the coupon to the nearest branch office.

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PHILADELPHIA ....1220 Jefferson Bldg.
ST. LOUIS.....1794 Arcade Bldg.
SEATTLE.....1301 L. C. Smith Bldg.
BIRMINGHAM..412 Jefferson Bank Bldg.
PORTLAND .....516 Porter Bldg.
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THE AUSTIN CO. OF TEXAS:
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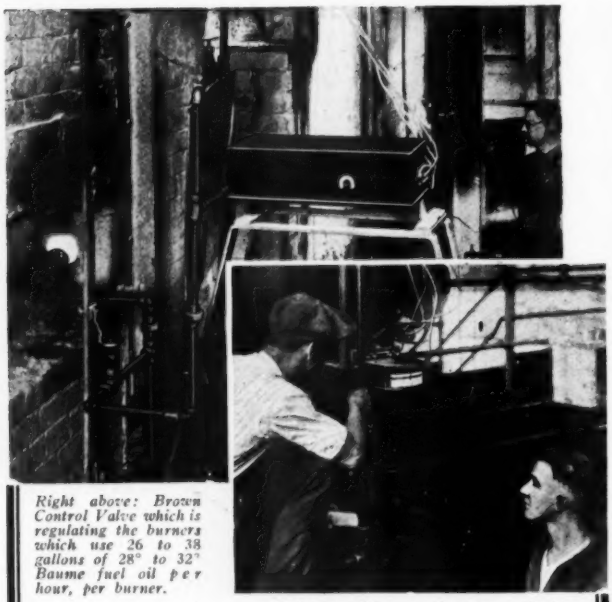

Right above: Brown Control Valve which is regulating the burners which use 26 to 38 gallons of 28° to 32° Baume fuel oil per hour, per burner.

Chief Electrician at the Owens Bottle Co., Glassboro, N. J., instructing a worker how to "set" the Control.

The Owens Bottle Co. Writes:

"About one and one-half years ago you placed one of your heat controlling apparatus on one of our Revolving Tanks. It has functioned in an excellent manner during this time. The saving of fuel oil has been of quite some volume and due to the regularity of the temperature, the production has been improved in quality and quantity."

(Signed) C. W. SCHWENZFEIER
FACTORIES MANAGER, Eastern Dist.

Let us tell you what Brown Automatic Control is doing in the Glass Industry. Write today for our new Automatic Temperature Control Catalog No. 86. Address The Brown Instrument Company, 4513 Wayne Ave., Philadelphia, Pa., or one of our district offices at New York, Boston, Pittsburgh, Cleveland, Columbus, Birmingham, Detroit, Chicago, Indianapolis, St. Louis, Denver, Los Angeles, San Francisco, Montreal.

Brown *Automatic Control* **Pyrometers**

Quality Decides—

ALKALI

Wherever glass is made Diamond 58% Soda Ash is recognized for its superior quality.

ALKALI

"Diamond Tested" is more than a name. It is a guarantee of the highest quality.

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PITTSBURGH, PENNA.

SOLVAY

STANDARD IN SODA SINCE 1881

Dustless Dense Soda Ash For Glassmakers

Write for TECHNICAL BULLETIN No. 1, Solvay Standard Methods for Testing of Soda Ash.

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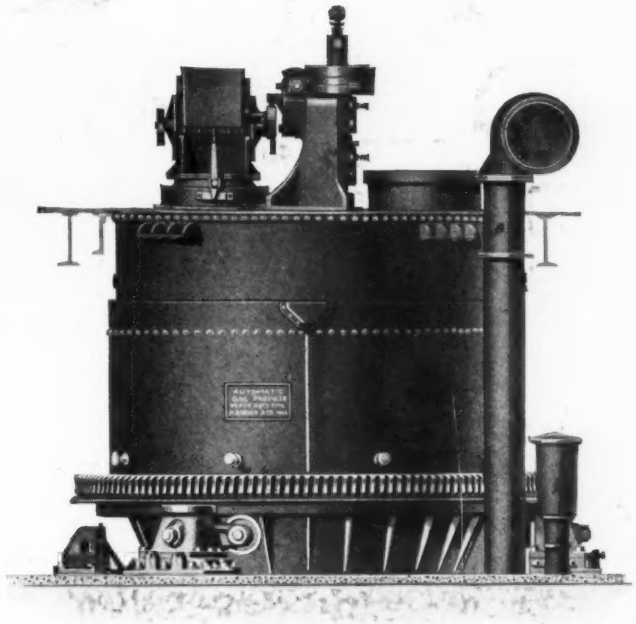

Do you know R. D. Wood & Co.'s Automatic Gas Producers?

If you do, you are undoubtedly using them or expect to.

If not, you will be interested in their value to you.

They are not only entirely automatic and continuous in their operation but are so carefully designed and of such sturdy construction that they are the most reliable machines on the market. Cost of upkeep is thus reduced to a minimum.

R. D. Wood and Company's Automatic Gas Producers are built in two sizes: the "Heavy Duty" type having a capacity up to 50 tons —and the "M. C." type gasifying up to 30 tons of bituminous coal in 24 hours.

For years a considerable number of plants have depended on only one of these producers for each furnace. The large number of these machines installed have a total gasifying capacity of over 7,700 tons of coal per 24 hours.

Catalog mailed on request.

HYDRAULIC MACHINERY & OPERATING VALVES

R. D. WOOD & CO.

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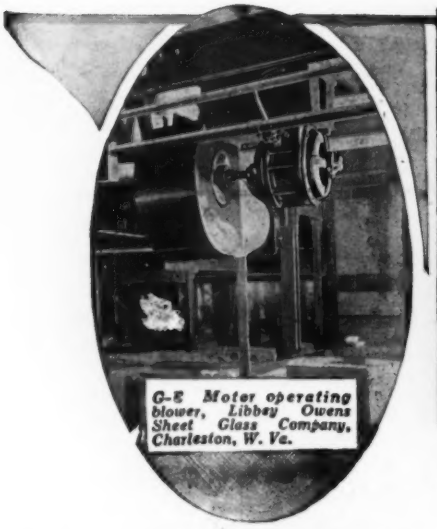
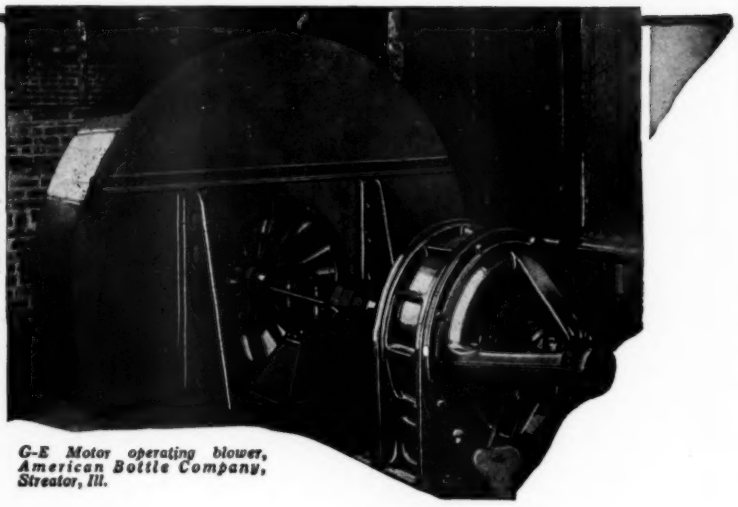
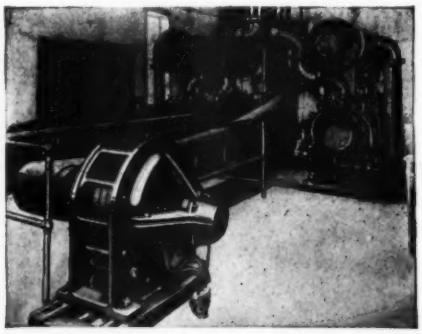


G-E Motor operating blower, Libbey Owens Sheet Glass Company, Charleston, W. Va.



G-E Motor operating blower, American Bottle Company, Streator, Ill.

G-E Motors driving pumps, Libbey Owens Sheet Glass Company, Charleston, W. Va.



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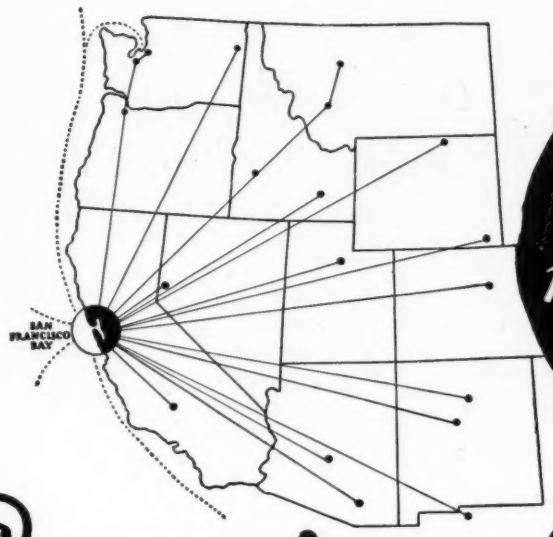

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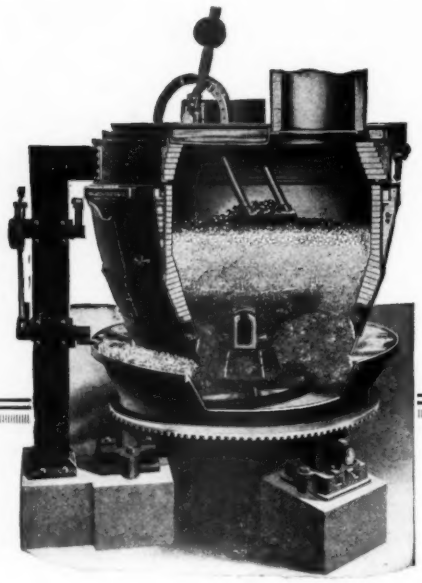

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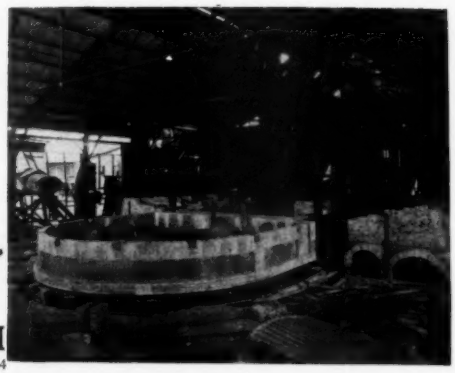

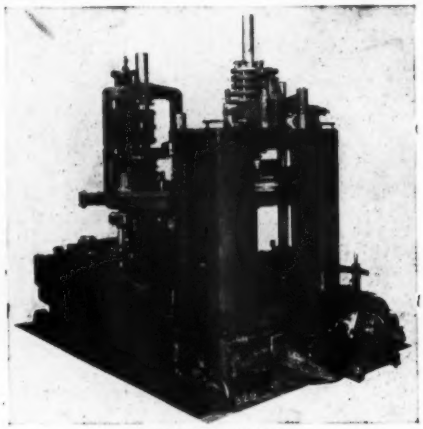

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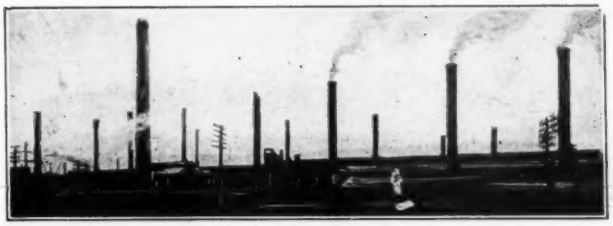

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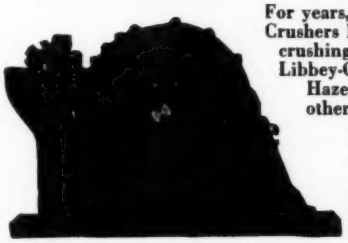

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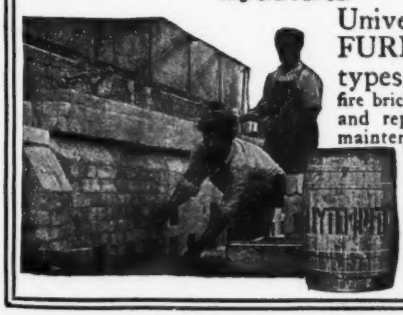

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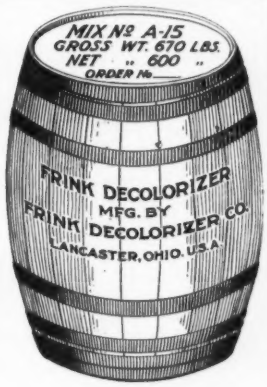

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O'Neill Machine Co., Toledo, O.
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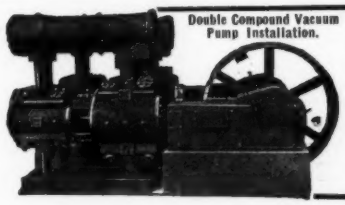
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